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and notes through the volume

ADVANCED PAGES.

AN

ELEMENTARY ARITHMETIC.

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TABLE FOR VARYING QUESTIONS.

Animals. . . . Dog, Puppy, Cat, Kitten, Rabbit, Cow, Calf, Pig, Horse, Colt, Sheep, Lamb, Goat, Kid, Fox, Mouse, Squirrel, Monkey.

Birds. . . . . Robin, Sparrow, Swallow, Canary, Parrot, Crow, Blue-bird, Kingbird, Hawk, Owl, Jay, Loon, Swan, Pigeon.

Clothes . . . . Hat, Cap, Bonnet, Coat, Vest, Dress, Socks, Boots, Shoes, Collar, Cuffs, Slippers, Rubbers, Mittens, Gloves.

Flowers . . . . Rose, Pink, Daisy, Pansy, Lily, Geranium, Violet, Poppy.

Fowls . . . . Hen, Chicken, Turkey, Duck, Goose, Gosling.

Fruits . . . . . Apple, Pear, Quince, Orange, Lemon, Peach, Grape, Fig.

Garden. . . . . Peas, Beans, Corn, Potatoes, Carrots, Parsnips.

House . . . . . Room, Door, Window, Chair, Table, Picture, Carpet, Cup, Plate, Saucer, Fork, Knife, Spoon, Pitcher, Clock.

Insects. . . . . Fly, Spider, Bee, Hornet, Butterfly, Beetle, Cricket.

School . . . . . Desk, Slate, Pencil, Pen, Book, Paper, Chair.

Smallwares. . Buttons, Pins, Needles, Spools of Thread.

Store. . . . . Tea, Coffee, Sugar, Starch, Soap, Candles, Matches, Eggs, Axe, Rake, Pail, Spade, Hoe, Saw, Nails.

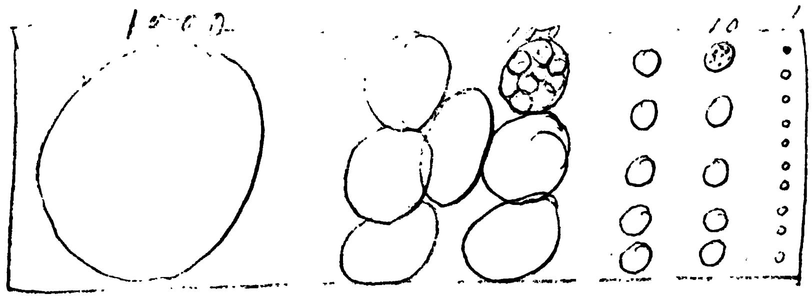
Toy-Store. . . Doll, Top, Ball, Whip, Basket, Marbles, Whistle.

Tradesmen. . Baker, Butcher, Grocer, Milkman, Blacksmith.

Trees. . . . . Apple, Oak, Cherry, Plum, Ash, Birch, Beech.

Vehicles . . . Train, Car, Coach, Hack, Buggy, Wagon, Gig, Sleigh, Sled, Barge, Bus.

Number Board f. sticks.



ELEMENTARY ARITHMETIC.

Part I.

Part I. is intended as a guide to teachers in oral and blackboard work for children before they can read. After they can read, a rapid review will help fix their knowledge of simple arithmetical processes.

THINGS NEEDED.

1. **Objects for Counters.** Such as cents, blocks, buttons, spools, pencils, nails, little tin plates, cups and saucers, inch-squares of pasteboard, foot-rules, yard-sticks, a set of tin measures for liquids, a set of wooden measures for dry articles, and a set of weights.

2. **A Counting-Board.** This is of great assistance in teaching arithmetical processes with small numbers. It is simply a smooth board with 100 holes about an inch apart, arranged in 10 rows of 10 holes each. Nails or wooden pins can be used for counters.

Another way of making the counting-board is to drive 100 nails in 10 rows of 10 nails each through a piece of board, at suitable distances from each other, until they project about an inch, and use spools for counters, slipping them on the ends of the nails.

LESSON 1.

THE NUMBER ONE.

Show me *one* finger; *one* block; *one* button.

How many suns do we see by day? How many moons by night?

We write *one* by the word **one.**

We write the **figure 1** for **one.**

Write this row of 1's: 1 1 1 1 1 1 1 1 1

THE NUMBER TWO.

How many fingers are *one* finger and *one* finger?

Hold up **two** fingers; **two** hands.

We write the **figure 2** for **two.**

Write this row of 2's: 2 2 2 2 2 2.

How many balls are ● and ●?

How many cups are ☕ and ☕?

How many dolls are 1 doll and 1 doll?

How many horses are 1 horse and 1 horse?

How many are 1 and 1?

Here are two blocks, ■ ■. Take away ■. How many are left?

1 apple from 2 apples leaves how many?

1 from 2 leaves how many?

How many more pears are 🍐 🍐 than 🍐?

How many more dolls are 2 dolls than 1 doll?

How many rings must you put with ○ to have ○ ○?

How many apples must you put with 1 apple to have 2 apples?

NOTE. The following plan is recommended to the Teacher, for the number-work of Part I.:

1. Show objects, and secure the desired result from them.
2. Draw pictures of blocks, squares, etc., on the board, and obtain the same result from the pictures.
3. Ask the same question on familiar but unseen objects.
4. Finish with abstract numbers.

The Teacher can vary the questions at pleasure by using different objects and different pictures, and by using the table of familiar objects given opposite the first page.

THE NUMBER THREE.

How many fingers are *two* fingers and *one* finger?
Hold up **three** fingers.
We write the **figure 3** for **three.**

Copy each square below, and write under it the figure for the number of dots in the square:

Count the dots in these squares from left to right.
Count the dots from right to left.
What number follows 1? What number follows 2?
What number comes before 2? before 3?
What number is between 1 and 3?
Copy these pictures, and write under each group the figure for the number in the group:

△ △ △ □ □ □

× × × ○ ○ ○

How many pears are and and ?
How many balls are and and ?
How many dogs are 1 dog and 1 dog and 1 dog?
How many boys are 1 boy and 1 boy and 1 boy?
How many are 1 and 1 and 1?
How many stars are ✶ ✶ and ✶?
How many squares are □ □ and □?
How many kittens are 2 kittens and 1 kitten?
How many birds are 2 birds and 1 bird?
How many are 2 and 1?

How many apples are  and ?
How many pinks are 1 pink and 2 pinks?
How many are 1 and 2?

Here are three blocks, 
Take 1 block away, how many will be left?
Take 2 blocks away, how many will be left?
Take 3 blocks away, how many will be left?
How many more blocks are than ?
How many more cows are 3 cows than 2 cows?
How many more figs are 3 figs than 1 fig?

How many blocks must be put with to make ?

How many baskets must be put with  to make ?

How many plums must be put with 2 plums to make 3 plums?

How many plums must be put with 1 plum to make 3 plums?

James may take 1 block; then 1 more; and then 1 more.

How many *times* has James taken 1 block? How many blocks has he? Then 3 times 1 block are how many blocks?

How many chairs are 3 times 1 chair?

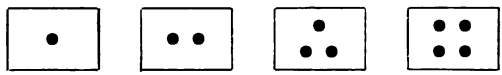
Here are 3 apples, . How many boys can each have 1 apple?

Here are 3 dolls. How many girls can each have 1 doll? How many *ones* in 3?

THE NUMBER FOUR.

Three dots and *one* dot make **four** dots.
Here are *four* dots, ● ● ● ●
We write the **figure 4** for **four.**

Copy each square below, and write under it the figure for the number of dots in the square:



Count the dots in these squares from left to right.
Count the dots from right to left.
What number follows 2? What number follows 3?
What number comes before 4? before 3?
What number is between 1 and 3? 2 and 4?

Copy these pictures, and write under each group the figure for the number in the group:

How many sides has this square □?
How many legs has a horse? a frog? a cow?
How many stars are ✶ ✶ ✶ and ✶?
How many rings are ○ ○ ○ and ○?
How many crosses are + and + + +?
How many eggs are ○ and ○ ○ ○?
How many boys are 3 boys and 1 boy?
How many mice are 1 mouse and 3 mice?
How many are 3 and 1? 1 and 3?

LESSON 6.

How many stars are * * and * * ?

How many marks are // and // ?

How many brooms are 2 brooms and 2 brooms ?

How many are 2 and 2 ?

Here are four blocks, 

Cover one block. How many can you see ?

Then 1 from 4 leaves how many ?

Cover two blocks. How many can you see ?

Then 2 from 4 leaves how many ?

Cover three blocks. How many can you see ?

Then 3 from 4 leaves how many ?

Cover all four blocks. How many can you see ?

Then 4 from 4 leaves how many ?

How many more tops are  than  ?

How many more balls are  than  ?

How many more crosses are  than  ?

How many more cars are 4 cars than 3 cars ? than 2 cars ? than 1 car ?

How many more apples are 4 apples than 2 apples ? than 1 apple ? than 3 apples ?

How many ladders must be put with to make  ?

How many pears must be put with to make ?

How many crosses must be put with X X X to make X X X X ?

How many bells must be put with 2 bells to make 4 bells ?

Here are 4 blocks, 

Susie may take 1 block; then 1 more; then 1 more; and then 1 more. How many *times* has Susie taken 1 block? How many blocks has she? Then how many blocks are 4 times 1 block?

How many apples are 4 times 1 apple?

How many figs are 4 times 1 fig?

How many are 4 times 1?

Ernest may take 2 blocks; and then 2 more. How many *times* has Ernest taken 2 blocks? How many blocks has he? Then how many blocks are 2 times 2 blocks?

How many cakes are 2 times 2 cakes?

How many rolls are 2 times 2 rolls?

How many are 2 times 2?

Here are 4 apples,  . How many boys can have 1 apple? How many *ones* in 4?

Here are 4 tops,  . How many boys can have 2 tops? How many *twos* in 4?

Here are 4 dots, ● ● ● ●

Divide them into *two equal parts*, thus ● ●/● ●

How many dots in each part?

When a number of things is divided into **two equal parts,** each part is called **one-half** of the whole number.

What is one-half of

4 ~~blocks~~  ? 4 cents?

4 books? 4 buns? 2 oranges?

THE NUMBER FIVE.

Four dots and *one* dot make **five** dots.

Here are *five* dots, ⁘

We write the **figure** 5 for **five.**

How many fingers on your right hand?

How many fingers on your left hand?

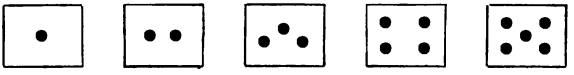
Copy these pictures, and write under each group the figure for the number in the group:

△ △ △ △ △ × × × × ×

□ □ □ □ □ ✱ ✱ ✱ ✱ ✱

+ + + + + ○ ○ ○ ○ ○

Copy each square below, and write under it the figure for the number of dots in the square:



Count the dots in these squares from left to right.

Count the dots from right to left.

What number follows 4? What number follows 2?

What number comes before 5? before 2? before 4?

What number is between 3 and 5? 2 and 4?

How many stars are ✱ ✱ ✱ ✱ and ✱?

How many tops are 🝖 🝖 🝖 🝖 and 🝖?

How many ladders are 目 and 目 目 目 目?

How many crosses are + and + + + +?

How many apples are 4 apples and 1 apple?

How many plums are 1 plum and 4 plums?

How many are 4 and 1? 1 and 4?

How many marks are / / and / / / ?
How many bottles are  and  ?
How many balls are  and  ?
How many mugs are  and  ?
How many figs are 3 figs and 2 figs ?
How many spoons are 2 spoons and 3 spoons ?
How many cars are 3 cars and 2 cars ?
How many lambs are 3 lambs and 2 lambs ?
How many are 2 and 3 ?
How many are 3 and 2 ?
Here are five blocks, 
Cover one block. How many can you see ?
Then 1 from 5 leaves how many ?
Cover two blocks. How many can you see ?
Then 2 from 5 leaves how many ?
Cover three blocks. How many can you see ?
Then 3 from 5 leaves how many ?
Cover four blocks. How many can you see ?
Then 4 from 5 leaves how many ?
Cover five blocks. How many can you see ?
Then 5 from 5 leaves how many ?
How many more dots are ● ● ● ● ● than ● ● ● ● ?
How many more stars are ∗ ∗ ∗ ∗ ∗ than ∗ ∗ ∗ ?
How many more crosses are × × × × × than × × ?
How many more balls are  ?
How many more hens are 5 hens than 3 hens ?
How many more dogs are 5 dogs than 2 dogs ?
How many more lambs are 5 lambs than 4 lambs?
How many more pigs are 5 pigs than 1 pig ?

How many rings must be put with ○ to make ○ ○ ○ ○ ○?

How many stars must be put with ∗ ∗ ∗ ∗ to make ∗ ∗ ∗ ∗ ∗?

How many crosses must be put with × × to make × × × × ×?

How many marks must be put with /// to make /////?

How many cents must be put with 2 cents to make 5 cents?

How many balls must be put with 3 balls to make 5 balls?

How many pigeons must be put with 1 pigeon to make 5 pigeons?

How many pears must be put with 4 pears to make 5 pears?

If Frank takes 1 block at a time for 5 times, how many blocks will he have?

Then 5 times 1 block are how many blocks?

5 times 1 apple are how many apples?

5 times 1 cup are how many cups?

Here are 5 tops, 

How many boys can have 1 top apiece?

How many *ones* in 5?

How many boys can have 2 tops apiece?

How many will be left for another boy?

How many *twos* in 5, and how many over?

How many *threes* in 5, and how many over?

How many *fours* in 5, and how many over?

THE NUMBER SIX.

Five dots and *one* dot make **six** dots.

Here are *six* dots, ⁘

We write the **figure 6** for **six.**

Copy these pictures, and write under each group the figure for the number in the group:

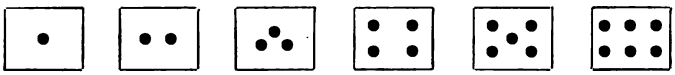
* * * * * * //////

△ △ △ △ △ △ × × × × × ×

○ ○ ○ ○ ○ ○ □ □ □ □ □ □

Copy each square below, and write under it the figure for the number of dots in the square:



Count these dots from left to right.

Count these dots from right to left.

What number follows 4? What number follows 5?

What number comes before 4? before 6? before 5? before 3? before 2?

What number is between 4 and 6? 3 and 5?

How many balls are ◉ ◉ ◉ ◉ ◉ and ◉?

How many tops are  and ?

How many boxes are 5 boxes and 1 box?

How many brooms are 1 broom and 5 brooms?

How many birds are 5 birds and 1 bird?

How many oranges are 1 orange and 5 oranges?

How many are 5 and 1? 1 and 5?

How many stars are ✶ ✶ ✶ ✶ and ✶ ✶?
How many rings are ○ ○ and ○ ○ ○ ○?
How many balls are ◎ ◎ and ◎ ◎ and ◎ ◎?
How many kittens are 4 kittens and 2 kittens?
How many horses are 4 horses and 2 horses?
How many buns are 2 buns and 4 buns?
How many pies are 2 pies and 4 pies?
How many are 4 and 2? 2 and 4?
How many crosses are ✠ ✠ ✠ and ✠ ✠ ✠?
How many apples are 3 apples and 3 apples?
How many are 3 and 3?
Here are 6 blocks, ■ ■ ■ ■ ■ ■
Cover 1 block. How many can you see?
Then 1 from 6 leaves how many?
Cover 2 blocks. How many can you see?
Then 2 from 6 leaves how many?
Cover 3 blocks. How many can you see?
Then 3 from 6 leaves how many?
Cover 4 blocks. How many can you see?
Then 4 from 6 leaves how many?
Cover 5 blocks. How many can you see?
Then 5 from 6 leaves how many?
Cover 6 blocks. How many can you see?
Then 6 from 6 leaves how many?
How many more dots are ●●●●●● than ●●●●●?
How many more stars are ✶✶✶✶✶✶ than ✶✶✶✶?
How many more crosses are ××××××× than ×××?
How many more marks are /////// than ///?
How many more tops are ⛄⛄⛄⛄⛄⛄ than ⛄?

How many more chairs are 6 chairs than 5 chairs?

How many more boxes are 6 boxes than 4 boxes?

How many more cars are 6 cars than 3 cars?

How many more dogs are 6 dogs than 2 dogs?

How many more pears are 6 pears than 1 pear?

How many marks must be put with ///// to make //////?

How many tops must be put with to make ?

How many stars must be put with * * * to make * * * * * *?

How many balls must be put with to make ?

How many squares must be put with □ to make □ □ □ □ □ □?

How many bells must be put with 3 bells to make 6 bells?

How many caps must be put with 2 caps to make 6 caps?

How many pies must be put with 4 pies to make 6 pies?

How many cups must be put with 1 cup to make 6 cups?

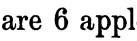
How many books must be put with 5 books to make 6 books?

Here are 6 blocks, 

If Hattie takes 2 blocks at a time for 3 times, how many blocks will she have?

Then how many blocks are 3 times 2 blocks?

Here are 6 blocks,
John may take 3 blocks; then 3 more.
How many times has John taken 3 blocks?
How many blocks has he?
Then how many blocks are 2 times 3 blocks?
How many oranges are 2 times 3 oranges?
How many are 2 times 3?

Here are 6 apples, 
How many girls can have 1 apple?
How many *ones* in 6?
How many girls can have 2 apples?
How many *twos* in 6?
How many girls can have 3 apples?
How many *threes* in 6?

Here are 6 dots, ● ● ● ● ● ●
Divide them into two equal parts, ●●●/●●●
How many dots are there in each part?
What is one-half of 6 dots? 6 cents?
What is one-half of 4 apples? 2 pens?
Divide 6 dots into *three* equal parts, thus, ●●/●●/●●
How many dots are there in each part?
When a number of things is divided into **three equal parts,** each part is **one-third** of the number.
What is one-third of 6 dots? of 6 cents?
How many dots are two-thirds of 6 dots?
How many dots are three-thirds of 6 dots?
How many oranges are two-thirds of 6 oranges?

How many apples at 2 cents apiece can you buy for 4 cents? How many for 6 cents?

How many boots does it take to make a pair of boots? How many horses to make a pair of horses?

How many pairs of boots does it take for 3 boys?

How many boots in 2 pairs of boots? How many horses in 3 pairs of horses? How many oxen in 3 pairs of oxen?

The butcher has 2 horses, the grocer 2 horses, and the baker has 1 horse. How many horses have they in all?

Mary has 3 cages, and 1 bird in each cage. How many birds has she?

There were 5 sheep in the pasture, and each sheep had 1 lamb. How many lambs were there?

There were 5 apples on a limb. Three fell off. How many were left?

Harold had 5 cents, and bought a postage stamp for two cents. How many cents did he have then?

A blacksmith had 6 horses to shoe. He shod half of them. How many more had he to shoe?

A blacksmith shod 4 horses before dinner, and 2 after dinner. How many did he shoe?

John and his papa hoed 6 rows of corn. John hoed one-third of the 6 rows, and his papa two-thirds of them. How many rows did each hoe?

What part of 6 apples are 2 apples?

What part of 6 apples are 3 apples?

At 3 cents apiece how many oranges can you buy for 6 cents?

At 2 cents apiece how many apples can you buy for 6 cents?

If you can buy 3 sticks of candy for 2 cents, how many sticks can you buy for 4 cents?

If you have 6 eggs, 2 on a plate, how many plates have you?

If you can buy 2 apples for 3 cents, how many apples can you buy for 6 cents?

What is one-half of 6 cents? one-third of 6 cents? two-thirds of 6 cents? three-thirds of 6 cents?

Charlie sold 3 newspapers for 2 cents a paper. How many cents did he get for the 3 papers?

It takes 2 cents to buy a paper. How many papers can you buy for 4 cents? for 6 cents?

If you have six cents, and spend half of your money, how many cents will you have left?

How many balls in one-half of 6 balls? in two-halves of 6 balls?

How many blocks in one-third of 6 blocks? in two-thirds of 6 blocks? in three-thirds of 6 blocks? ~~in three-thirds of 4 blocks?~~

If a cook has 6 eggs, and uses one-third of them for cake, how many eggs will be left?

A little boy had 4 newspapers to sell, and he sold half of them. How many papers had he left?

How many pears are one-half of 4 pears and one-half of 6 pears together?

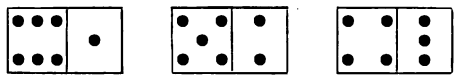
THE NUMBER SEVEN.

Six dots and *one* dot make **seven** dots.

Here are seven dots, ⁘•

We write the **figure 7** for **seven.**

Draw these cards, and write 7 under each card.



How many are 3 and 4? 4 and 3? 1 and 6? 2 and 5? 5 and 2? 6 and 1?

How many are 7 less 3? 7 less 4? 7 less 1? 7 less 2? 7 less 5? 7 less 6? 7 less 7?

How many more are 7 chairs than 3 chairs? 7 balls than 4 balls? 7 kittens than 1 kitten? 7 mice than 5 mice? 7 ladders than 2 ladders? 7 stars than 6 stars?

How many dolls must you put with 3 dolls to have 7 dolls?

How many cups must you put with 4 cups to have 7 cups?

How many hats must you put with 1 hat to have 7 hats?

How many cents must you put with 2 cents to have 7 cents?

How many eggs must you put with 5 eggs to have 7 eggs?

How many cents must you put with 6 cents to have 7 cents?

There are 4 pigs in 1 pen and 3 pigs in another pen. How many pigs in both pens?

How many must you add to 5 to make 7?

If you draw 7 stars and rub out 3 of them, how many will be left? How many are 7 less 3?

How many crosses are 6 crosses and 1 cross?

If you have 7 pears and give away 6 of them, how many pears will you have left?

How many are 7 less 6? 7 less 1? 7 less 3? 7 less 5? 7 less 2? 7 less 4?

How many mittens make a *pair* of mittens?

How many boots make a *pair* of boots?

Here are 7 blocks,  . Call them horses, and find how many pairs of horses you can have, and how many single horses besides?

NOTE. Show the pupils one-cent, two-cent, and five-cent coins. Let them count out the number of single cents a two-cent piece equals in value, and the number a five-cent piece equals in value. Show the one-cent, two-cent, three-cent, four-cent, and five-cent postage stamps.

At 1 cent apiece, how many apples can you buy for a two-cent piece? for a five-cent piece?

Harry has a two-cent piece and a five-cent piece. How many one-cent postage stamps can he buy?

If you add 1 block to 3 times 2 blocks, how many blocks will you have?

How many are □ □ and □ □ and □ □ and □?

How many are □ □ □ and □ □ □ and □?

How many are 2 and 2 and 2 and 1?

How many are 3 and 3 and 1?

Alice has a five-cent piece and a two-cent piece, and Harry has six cents. How much more money has Alice than Harry?

How many peaches are 3 peaches and 4 peaches?

A farmer had 7 horses. If he had 3 turned out in the pasture, and the rest in the stable, how many did he have in the stable?

There were 7 windows in a room, and 2 of them were shut. How many were open?

There were 7 eggs in a basket, but the cook used 5 of them. How many were left?

A storekeeper had 7 saws. He sold one saw to a carpenter. How many had he left?

A man had 7 cows to milk. When he had milked 6 cows, how many had he to milk?

If one apple costs 1 cent, how much will 7 apples cost? 5 apples? 3 apples? 6 apples?

If one peach costs 2 cents, how much will 3 peaches cost? 2 peaches?

If you can buy one pencil for 2 cents, how many pencils can you buy for 6 cents? for 4 cents?

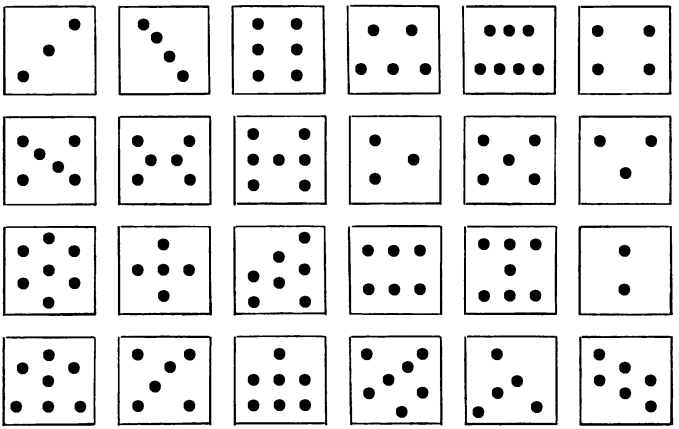
How many three-cent stamps can you buy for 3 cents? for 6 cents?

George has 7 cents. How many oranges can he buy at 3 cents each, and how many cents will he have left?

Ellen has 7 cents. How many pears can she buy at 2 cents each, and how many cents will she have left?

DRILL EXERCISE.

NOTE. The Teacher may put the following groups of dots on the board, and call upon the pupils *one by one* to tell the number of dots as she touches the squares at random, with a pointer. *Every child* should be carefully drilled on this exercise until he can name each number of dots instantly.



Name two numbers that together make 4.
Name two numbers that together make 5.
Name three numbers that together make 5.
Name two numbers that together make 6.
Name three numbers that together make 6.
Name two numbers that together make 7.
Name three numbers that together make 7.
Name four numbers that together make 7.
How many more are 6 than 4 ? than 3 ?
How many more are 5 than 3 ? than 2 ?
How many more are 7 than 4 ? than 5 ?
How many more are 7 than 3 ? than 2 ?

THE SIGNS = AND +.

The sign = stands for the word **are**.
Copy, and use the sign that stands for *are*:

1 and 1	2.	5 and 1	6.
2 and 1	3.	2 and 5	7.
4 and 3	7.	3 and 2	5.
2 and 4	6.	2 and 2	4.

The sign + stands for the word **and**.
Copy, and use the sign that stands for *and*:

3	1 = 4.	3	3 = 6.
1	2 = 3.	3	4 = 7.
4	2 = 6.	5	2 = 7.
2	3 = 5.	1	5 = 6.

Copy, and write each answer at the right of the sign =:

1 + 1 =	1 + 2 =	3 + 1 =
2 + 4 =	1 + 4 =	4 + 1 =
3 + 2 =	3 + 3 =	1 + 5 =
1 + 3 =	5 + 2 =	3 + 4 =
2 + 2 =	4 + 2 =	6 + 1 =
2 + 1 =	1 + 6 =	4 + 3 =

1 + 1 + 1 =	2 + 2 + 2 =
2 + 1 + 1 =	1 + 2 + 3 =
2 + 2 + 1 =	2 + 3 + 2 =
3 + 1 + 2 =	3 + 3 + 1 =
3 + 2 + 2 =	2 + 3 + 1 =
5 + 1 + 1 =	4 + 1 + 2 =

THE SIGNS − AND ×.

The sign − stands for the word **less.**

When we take 3 blocks from 5 blocks, we have 2 blocks left.

We write this fact thus,

5 blocks − 3 blocks = 2 blocks;

and we read this,

5 blocks *less* 3 blocks are 2 blocks.

Oral and slate exercises:

BLOCKS.	BLOCKS.	BLOCKS.
3 − 1 =	6 − 1 =	6 − 4 =
2 − 1 =	6 − 3 =	5 − 4 =
4 − 2 =	7 − 1 =	7 − 5 =
5 − 3 =	5 − 2 =	7 − 3 =
3 − 2 =	7 − 2 =	7 − 4 =

The sign × stands for the word **times.**

PEARS.	PEARS.	PEARS.
3 × 1 =	2 × 3 =	5 × 1 =
2 × 1 =	4 × 1 =	7 × 1 =
2 × 2 =	6 × 1 =	3 × 2 =

NOTE. The pupils should copy the above, and similar exercises, on blocks of paper or slates, and write the answer for each example.

Also the Teacher should put these exercises on the blackboard, and with pointer in hand require of *each pupil in turn* quick answers to such examples as she touches with the pointer. One child at a time should give the answers aloud, and the other members of the class should be on the alert to raise their hands when a wrong answer is given. If a child gives a wrong answer, he should be sent to the counting-board to discover the true answer.

THE DAYS OF THE WEEK.

On what day of the week do we go to church?

The next day we come to school. Who can tell the name of the day that follows Sunday?

Who can tell the name of the day that follows Monday?

What day comes after Tuesday?

What day comes after Wednesday?

What day comes after Thursday?

The day that follows Friday we have for a holiday. What is the name of that day?

We will write the first letter of each day, thus:

S _____,
M _____,
T _____,
W _____,
T _____,
F _____,
S _____.

Repeat with me the days of the week, beginning with Sunday.

Wednesday is the middle day of the week.

What day comes before Wednesday?

How many days make a week?

Remember: **7 days make 1 week.**

NOTE. The Teacher should make sure that *all* the pupils of the class give close attention and learn the days of the week, and not be satisfied if *some one* in the class can repeat them. In fact, *this caution applies to all class-work.*

THE NUMBER EIGHT.

Seven dots and *one* dot make **eight** dots.

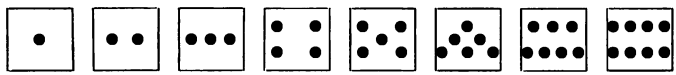
Here are *eight* dots, ⁘

We write the **figure 8** for **eight**.

Copy these pictures, and write under each group the figure for the number in the group:

× × × × × × × × 

Copy each square below, and write under it the figure for the number of dots in the square.



Count the dots in these squares from left to right.

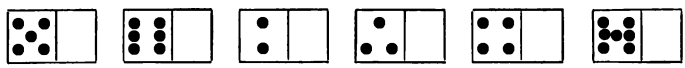
Count the dots from right to left.

What number follows 5? follows 7?

What number comes before 8? comes before 5?

What number is between 5 and 7? 6 and 8?

Copy, and add dots enough to make 8 dots in each card below:



How many blocks are 5 and 3? 6 and 2? 4 and 3? 4 and 4? 2 and 5? 2 and 6? 7 and 1?

How many dots must be put with 5 to make 8? with 2 to make 8? with 3 to make 8? with 4 to make 8? with 7 to make 8? with 6 to make 8?

How many more dots are 8 than 6? 8 than 3? 8 than 4? 8 than 2? 8 than 1? 8 than 5?

Here are 8 blocks, 

If you take away 2 blocks, how many will be left?

If you take away 6 blocks, how many will be left?

If you take away 5 blocks, how many will be left?

If you take away 3 blocks, how many will be left?

If you take away 4 blocks, how many will be left?

If you take away 1 block, how many will be left?

If you take away 7 blocks, how many will be left?

Ellen may take 2 blocks at a time for 4 times. How many blocks has she? How many blocks, then, are 4 times 2 blocks?

How many cups are 4 times 2 cups?

How many pears are 4 times 2 pears?

Erwin may take 4 blocks, and then 4 more. How many times has he taken 4 blocks? How many blocks has he? How many blocks, then, are 2 times 4 blocks?

How many plums are 2 times 4 plums?

How many apples are 2 times 4 apples?

How many are 4 times 2? How many are 2 times 4? How many 2's in 8? How many 4's in 8?

How many are 3 times 2? How many are 2 times 3? How many 2's in 6? How many 3's in 6?

How many oranges are one-half of 6 oranges?

How many apples are one-third of 6 apples?

When we take *one-half* of 6 oranges, into how many *equal parts* do we divide the 6 oranges?

When we take *one-third* of 6 apples, into how many *equal parts* do we divide the 6 apples?

Here are 8 blocks,

How many times must Nora go to bring these blocks to me if she brings just 2 blocks each time? Then 8 blocks divided by 2 blocks = 4 *times*.

But if Nora divides the blocks into two equal parts, how many blocks will there be in each part? Then 8 blocks divided by 2 = 4 *blocks*.

NOTE. The Teacher must illustrate in many ways the two different meanings of Division. When the divisor is a mere number, as 2, 3, 4, etc., the meaning of division then is the separation of the given number of things into 2, 3, 4, etc., equal parts, and the quotient will signify *a number of things like the dividend.* When the divisor is a *number of things like the dividend,* the quotient will signify *the number of times* the divisor is contained in the dividend; that is, the number of times the divisor can be taken from the dividend.

How many times are 2 cents contained in 6 cents?
How many times are 2 cents contained in 8 cents?
How many times are 4 cents contained in 8 cents?
How many times are 3 cents contained in 6 cents?

What is the answer for

8 cents divided by 4 cents?
8 pears divided by 2 pears?
6 peaches divided by 2 peaches?
6 plums divided by 3 plums?
8 chairs divided by 2 chairs?
8 oranges divided by 4 oranges?

This sign ÷ stands for the words **divided by.**

4 dogs ÷ 2 = ?	6 pears ÷ 3 = ?
4 hens ÷ 2 = ?	8 cents ÷ 2 = ?
6 figs ÷ 2 = ?	8 tops ÷ 2 = ?

Divide these eight dots thus, ●●/●●/●●/●●

Into how many *equal parts* have you divided them?

If a number of things is divided into **four equal parts,** each part is **one-fourth** of the number.

How many dots in *one-fourth* of 8 dots?

How many dots in two-fourths of 8 dots?

How many dots in three-fourths of 8 dots?

How many dots in four-fourths of 8 dots?

How many dots in one-half of 8 dots?

How many dots in two-halves of 8 dots?

Fourths are often called quarters.

Find one-quarter of 4 dollars; of 8 cents.

Find two-quarters of 4 dollars; of 8 cents.

Find three-quarters of 4 dollars; of 8 cents.

Find four-quarters of 4 dollars; of 8 cents.

Find one-half of 4 dollars; of 8 cents; of 8 pigs.

What part of 8 blocks are 4 blocks? are 2 blocks?

What part of 8 cents are 2 cents? are 4 cents?

What part of 6 cups are 3 cups? are 2 cups?

Which is greater, one-half of 8 cents or one-fourth of 8 cents? one-half of 8 cents or one-quarter of 8 cents?

Which is greater, one-half of 8 cents or two-fourths of 8 cents?

One-half, then, is equal to how many fourths?

Here is a new way of writing one-half, thus, $\frac{1}{2}$; one-third, thus, $\frac{1}{3}$; one-fourth, thus, $\frac{1}{4}$.

We write two-thirds, thus, $\frac{2}{3}$; two-fourths, thus, $\frac{2}{4}$; three-quarters, thus, $\frac{3}{4}$.

Read: $\frac{1}{2}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{1}{4}$; $\frac{2}{4}$; $\frac{3}{4}$; $\frac{4}{4}$.

Write in figures: one-half; one-third; two-thirds; one-fourth; three-quarters.

Oral and slate exercises:

DOGS.	CATS.	PIGS.
$5 + 2 =$	$7 - 2 =$	$7 - 5 =$
$5 + 3 =$	$8 - 5 =$	$8 - 3 =$
$6 + 2 =$	$8 - 6 =$	$8 - 2 =$
$7 + 1 =$	$8 - 1 =$	$8 - 7 =$
$2 + 2 =$	$3 + 3 =$	$4 + 4 =$
$4 - 2 =$	$6 - 3 =$	$8 - 4 =$
$2 \times 2 =$	$2 \times 3 =$	$3 \times 2 =$
$4 \div 2 =$	$6 \div 3 =$	$6 \div 2 =$
$2 \times 4 =$	$4 \times 2 =$	$8 \div 2 =$
$8 \div 4 =$	$\frac{1}{2}$ of $4 =$	$\frac{1}{2}$ of $6 =$
$\frac{1}{2}$ of $8 =$	$\frac{1}{3}$ of $6 =$	$\frac{3}{4}$ of $8 =$
$\frac{1}{4}$ of $8 =$	$\frac{2}{4}$ of $8 =$	$\frac{2}{3}$ of $6 =$

HORSES.		MULES.		COLTS.	
$4 +$	$= 7.$	$5 +$	$= 8.$	$7 -$	$= 3.$
$4 +$	$= 8.$	$7 +$	$= 8.$	$8 -$	$= 4.$
$4 +$	$= 6.$	$6 +$	$= 8.$	$8 -$	$= 1.$
$4 \times$	$= 8.$	$3 +$	$= 8.$	$8 -$	$= 6.$
$2 \times$	$= 8.$	$4 +$	$= 6.$	$8 \div$	$= 4.$
$3 \times$	$= 6.$	$8 -$	$= 5.$	$6 \div$	$= 3.$
$2 \times$	$= 6.$	$8 -$	$= 7.$	$8 \div$	$= 2.$
$2 \times$	$= 4.$	$8 -$	$= 3.$	$6 \div$	$= 2.$
$5 \times$	$= 5.$	$8 -$	$= 2.$	$4 \div$	$= 2.$

Which one of these measures is the smallest?
How many gills will the pint measure hold? *
Then four gills make one pint.
At 1 cent a gill, what will a pint of milk cost?
At 2 cents a gill, what will a pint of syrup cost?
How many gills in a half pint of water?

How many pints will the quart measure hold? *
Then two pints make one quart.
At 4 cents a pint, what will a quart of milk cost?
At 3 cents a pint, what will a quart of oil cost?
At 6 cents a quart, what will a pint of berries cost?
What part of a quart is 1 pint?
How many gills make 1 quart?

How many quarts will the gallon measure hold? *
Then four quarts make one gallon.
How many quart cans are needed for a gallon of milk? How many two-quart cans?
At 2 cents a quart, what will a gallon of skim-milk cost? What will a half-gallon cost?
What part of a gallon is one quart?
What part of a gallon are 2 quarts? are 3 quarts?
At 8 cents a gallon, what will a quart of skim-milk cost? What will a pint cost?

NOTE.* Let the pupil discover by trial the answer to this question.

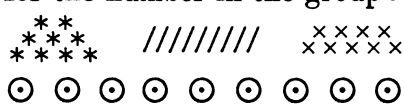
THE NUMBER NINE.

Eight dots and *one* dot make **nine** dots.

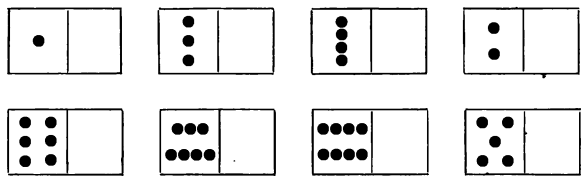
Here are *nine* dots, 

We write the **figure 9 for nine.**

Copy these pictures, and write under each group the figure for the number in the group:



Copy these cards, and add dots enough to make 9 dots in each card, and write 9 under each card:



How many dots are 3 and 6? 5 and 4? 7 and 2? 1 and 8? 3 and 3? 2 and 7? 4 and 3? 4 and 5? 4 and 4? 6 and 3? 8 and 1? 5 and 3?

How many dots must you put with 5 to make 9?

How many dots must you put with 2 to make 9?

How many dots must you put with 3 to make 9?

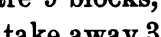
How many dots must you put with 4 to make 9?

How many dots must you put with 6 to make 9?

How many dots must you put with 8 to make 9?

How many dots must you put with 7 to make 9?

How many more dots are 9 than 7? 9 than 6? 9 than 3? 9 than 4? 9 than 5? 9 than 2?

Here are 9 blocks, 

If you take away 3 blocks, how many will be left?

If you take away 6 blocks, how many will be left?

If you take away 5 blocks, how many will be left?

If you take away 4 blocks, how many will be left?

If you take away 7 blocks, how many will be left?

If you take away 2 blocks, how many will be left?

If you take away 1 block, how many will be left?

If you take away 8 blocks, how many will be left?

How many are:

8 less 2?	9 less 3?	7 less 4?	9 less 4?
8 less 6?	9 less 6?	7 less 6?	9 less 5?
8 less 5?	9 less 7?	7 less 3?	8 less 3?
8 less 4?	9 less 8?	7 less 2?	9 less 1?
8 less 7?	9 less 2?	7 less 5?	9 less 7?

Emma may take 3 blocks at a time for 3 times.

How many blocks has Emma?

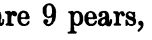
How many blocks, then, are 3 times 3 blocks?

How many peaches are 3 times 3 peaches?

How many roses are 3 times 3 roses?

How many lambs are 3 times 3 lambs?

How many are 3 times 3?

Here are 9 pears, 

How many times can you take 3 pears from the 9?

How many groups of 3 pears each can you make from the 9?

9 pears divided by 3 pears gives how many times?

9 pears divided by 3 gives how many pears?

How many pears are $\frac{1}{3}$ of 9 pears?

LESSON 32.

Here are 9 dots, ● ● ● ● ● ● ● ● ●

Put your pencil between the second and third dots. How many dots are on the left of the pencil? How many on the right of the pencil?

Put your pencil between the fourth and fifth dots. How many dots are on the left of the pencil? How many on the right of the pencil?

Put your pencil between the fifth and sixth dots. How many dots on the left? How many dots on the right?

If a boy goes up 8 steps 2 steps at a time, how many steps will he touch?

John had 9 flags, some of them red and the rest blue. If 4 of them were red, how many were blue?

Alice had 9 cents, and spent 3 cents. How many had she left?

George sells a newspaper for 2 cents, and receives a five-cent piece in payment. How many cents must he give back?

A hen had 9 chickens, but a hawk caught 2. How many chickens were left?

Miriam has 8 cents, and Hattie 3 less than Miriam. How many cents has Hattie?

Harry has 3 gibs, and Tom has 6 more than Harry. How many gibs has Tom?

I wanted 8 stamps for my letters, and had only 3. How many more must I buy?

Tom had 6 apples, and gave away $\frac{1}{3}$ of them. How many had he left?

Florence had 8 apples, 2 on a plate. How many plates were there? How many twos in eight?

Annie had 8 pears, 4 on a plate. How many plates were there? How many fours in eight?

Hattie had 9 peaches, 3 on a plate. How many plates were there? How many threes in 9?

$8 \div 2 =$	$8 \div 4 =$	$9 \div 3 =$
$\frac{1}{2}$ of 8 =	$\frac{1}{4}$ of 8 =	$\frac{1}{3}$ of 9 =

Mary had 3 rows of buttons, 3 in a row. How many buttons had she?

If one orange costs 3 cents, what will 2 oranges cost? What will 3 oranges cost?

If a quart of milk costs 6 cents, what will a pint cost? What will 3 pints cost?

If a pint of vinegar costs 4 cents, what will a gill cost? What will a quart cost?

If a pint of water will fill 4 gill cups, how many gill cups will a quart of water fill?

If a quart of milk will fill 2 pint cups, how many pint cups will a gallon of milk fill?

How many quart measures will a one-gallon can of milk fill? will a two-gallon can fill?

A cook had 9 eggs, and used $\frac{1}{3}$ of them for a pudding. How many eggs were left?

Harry had 8 oranges. He gave one-quarter of them to his sister Mary, one-quarter of them to his sister Alice, and one-quarter of them to his sister Ellen. How many did he keep for himself?

Oral and slate exercises :

FIGS.	BELLS.	APPLES.
$2 + 7 =$	$9 - 2 =$	$9 - 7 =$
$4 + 5 =$	$9 - 4 =$	$9 - 5 =$
$3 + 5 =$	$8 - 3 =$	$8 - 5 =$
$3 + 6 =$	$9 - 3 =$	$9 - 6 =$
$5 + 2 =$	$7 - 5 =$	$7 - 2 =$
$4 + 3 =$	$7 - 3 =$	$7 - 4 =$
$1 + 8 =$	$9 - 6 =$	$9 - 8 =$
$4 + 2 =$	$6 - 4 =$	$6 - 2 =$
$4 + 4 =$	$6 - 3 =$	$8 - 4 =$
$3 \times 3 =$	$\frac{1}{2}$ of $4 =$	$\frac{1}{2}$ of $6 =$
$\frac{1}{2}$ of $2 =$	$\frac{1}{3}$ of $3 =$	$\frac{1}{3}$ of $6 =$
$\frac{1}{3}$ of $9 =$	$\frac{1}{4}$ of $8 =$	$\frac{1}{2}$ of $8 =$

SLEDS.	ORANGES.	LAMBS.
$4 = 1 +$	$6 = 4 +$	$8 = 3 +$
$4 = 2 +$	$7 = 1 +$	$8 = 4 +$
$4 = 3 +$	$7 = 4 +$	$8 = 5 +$
$5 = 1 +$	$7 = 5 +$	$9 = 1 +$
$5 = 3 +$	$7 = 3 +$	$9 = 8 +$
$5 = 4 +$	$7 = 6 +$	$9 = 2 +$
$5 = 2 +$	$7 = 2 +$	$9 = 7 +$
$6 = 3 +$	$8 = 1 +$	$9 = 3 +$
$6 = 1 +$	$8 = 6 +$	$9 = 6 +$
$6 = 2 +$	$8 = 7 +$	$9 = 4 +$
$6 = 5 +$	$8 = 2 +$	$9 = 5 +$

NOTE. Besides copying and completing these and similar exercises, the oral drill must be kept up until *every one* of the class can give the answers promptly.

THE FIGURE ZERO.

The figure 0 is called **zero, naught,** or **cipher.**

The figure 0 means **none to count.**

Four roses grew on a bush; 2 were picked; and then 2 more. Write the figure for the number left.

Write the figure for the number of blocks left when you take away 5 blocks from 5 blocks.

Write the figure for the number of oranges left if you had 4 oranges and gave them all away.

You have now had *all* the figures used for writing numbers, and have learned the meaning of each separate figure. Thus:

The figure 1 is written for **One.**
The figure 2 is written for **Two.**
The figure 3 is written for **Three.**
The figure 4 is written for **Four.**
The figure 5 is written for **Five.**
The figure 6 is written for **Six.**
The figure 7 is written for **Seven.**
The figure 8 is written for **Eight.**
The figure 9 is written for **Nine.**
The figure 0 is written for **None.**

Write as *neatly* as you can all the figures used for writing numbers.

Draw a square, and write 0 under it; then another square, and write 1 under it; and so on to 9. Now put in each square the number of dots required by the figure written under it.

LESSON 36.

THE NUMBER TEN.

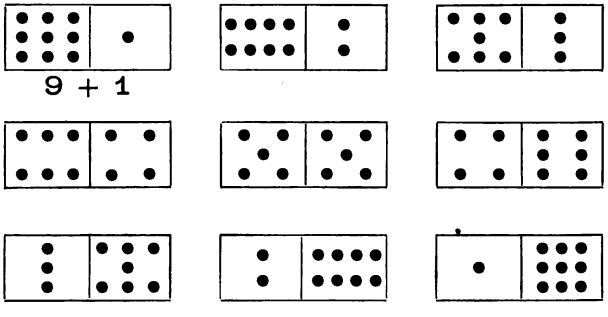
Nine dots and *one* dot make **ten** dots.

Here are *ten* dots, ● ● ● ● ●
● ● ● ● ●

We write the **figure 10** for **ten.**

Ten ones make 1 ten.

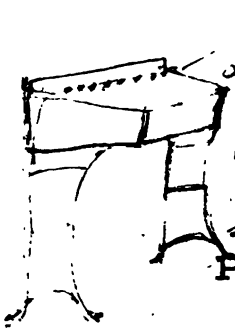
Draw these number pictures of ten, and write under each division the figure for the number of dots in the division:



Look at these number cards, and answer the following questions:

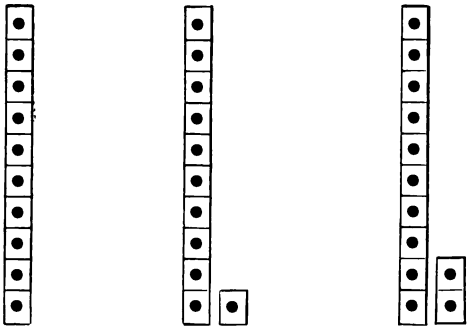
How many must you add to 9 to make 10? to 8 to make 10? to 7 to make 10? to 6 to make 10? to 5 to make 10? to 4 to make 10? to 3 to make 10? to 2 to make 10? to 1 to make 10?

How many more are 10 than 2? than 4? than 6? than 8? than 3? than 5? than 7? than 9?



Part II.

LESSON 1.



Look at the number picture on the right. What do you see over the 2? 2 **ones.** Over the 1 to the left of the 2? 1 **ten.** Then 12 means *one ten* and *two ones.*

Look at the middle number. What do you see over the 1 at the right? What do you see over the 1 at the left? Then 11 means *one ten* and *one.*

Look at the number picture on the left. What do you see over the 0? What do you see over the 1 which stands to the left of 0? Then 10 means *one ten* and *no ones.*

John may go to the counting-board. How many holes are there in the top row? Put one nail in one of the holes of the top row.

How many holes are left in the row?

Then how many must we add to 1 to make 10?

Put in one more nail. How many nails are there now? How many holes are left in the row?

Then how many must we add to 2 to make 10?

Put in one more nail. How many nails are there now? How many holes are left in the row?

How many must we add to 3 to make 10?

Put in one more nail. How many nails are there now? How many holes are left in the row?

How many must we add to 4 to make 10?

Put in one more nail. How many nails in the row? How many holes are left in the row?

How many must we add to 5 to make 10?

Put in one more nail. How many nails in the row? How many holes are left in the row?

How many must we add to 6 to make 10?

Put in one more nail. How many nails in the row? How many holes are left in the row?

How many must we add to 7 to make 10?

Put in one more nail. How many nails are there now? How many holes are left in the row?

How many must we add to 8 to make 10?

Put in one more nail. How many nails now in the row? How many holes are left in the row?

How many must we add to 9 to make 10?

Here are ten rings, OOOOOOOOOO

I will put the end of the pointer between the second and third rings.

How many rings on the left of the pointer?

How many rings on the right of the pointer?

How many are 2 and 8?

How many are 10 less 2? 10 less 8?

I will put the end of the pointer between the third and fourth rings.

How many rings on the left of the pointer?

How many rings on the right of the pointer?

How many are 3 and 7?

How many are 10 less 3? 10 less 7?

I will put the end of the pointer between the fourth and fifth rings.

How many rings on the left of the pointer?

How many rings on the right of the pointer?

How many are 4 and 6?

How many are 10 less 4? 10 less 6?

I will put the end of the pointer between the fifth and sixth rings.

How many rings on the left of the pointer?

How many rings on the right of the pointer?

How many are 5 and 5?

How many are 10 less 5?

How many are 10 less 1? 10 less 9?

NOTE. Practise this exercise, putting the pointer in different positions, until the pupils can readily name any two parts of 10, and the part left when one part is taken from 10.

In each of the number pictures below, the bundle is a bundle of ten.

Write the figures for the number in each case.

How many figures do you write for each number?
What does the figure on the left denote?
What does the figure on the right denote?

Remember: In numbers of two figures,

The figure on the right denotes ones;
The figure on the left denotes tens.

What is the number 11 called? Eleven.
What is the number 12 called? Twelve.

ROBINS.	ROBINS.	ROBINS.
$8 + ? = 10.$	$5 = 1 + ?$	$7 = 5 + ?$
$6 + ? = 10.$	$5 = 2 + ?$	$7 = 3 + ?$
$5 + ? = 10.$	$4 = 2 + ?$	$8 = 2 + ?$
$1 + ? = 10.$	$4 = 1 + ?$	$8 = 3 + ?$
$3 + ? = 10.$	$6 = 1 + ?$	$8 = 4 + ?$
$7 + ? = 10.$	$6 = 3 + ?$	$9 = 3 + ?$
$2 + ? = 10.$	$6 = 4 + ?$	$9 = 5 + ?$
$4 + ? = 10.$	$7 = 6 + ?$	$9 = 2 + ?$
$9 + ? = 10.$	$7 = 4 + ?$	$9 = 8 + ?$

NOTE. Continue these exercises until every pupil can separate 10 into any two parts, and see at a glance the number to be added to any part to make 10; and also see the part required when a number less than 10 and one of its parts are given.

There were 5 birds in a tree, and 5 more flew into the tree. How many birds were in the tree then?

A teamster has 2 teams of 5 horses each. How many horses has he?

Harry brought in some wood twice. The first time he brought in 4 sticks, and the next time 5 sticks. How many sticks did he bring in?

There are 4 plates on each side of a table, and one plate at each end. How many plates in all?

If a table is 3 feet long and 2 feet wide, how many feet long are the 2 sides and 2 ends together?

A farmer brought 10 bushels of potatoes to put into his cellar. After he had put in 6 bushels, how many more bushels remained to be put in?

Daisy has 10 chickens. Five are white, and the rest brown. How many are brown?

A room is 10 feet high, and the top of the door is 7 feet from the floor. How many feet from the top of the door is the ceiling?

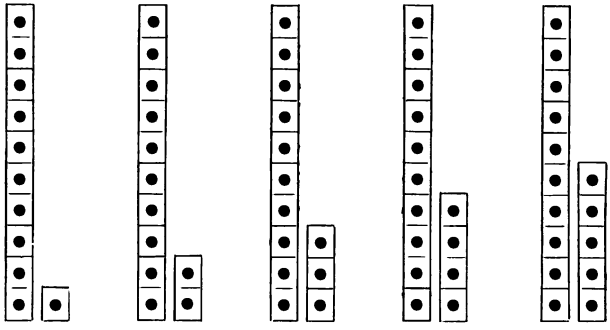
There were 10 saucers and only 8 cups. How many saucers were without cups?

I have 10 letters to mail, and only 1 stamp. How many stamps must I buy?

A ten-cent piece equals how many five-cent pieces? How many two-cent pieces? How many cents?

If a boy has 10 apples, and eats 2 apples a day, how many days will they last?

If a boy has 10 cents, and spends half of them, how many will he have left?



How many dots are 10 dots and 1 dot? 10 dots and 2 dots? 10 dots and 3 dots? 10 dots and 4 dots? 10 dots and 5 dots?

How many sheep are 10 sheep and 1 sheep? 10 sheep and 2 sheep? 10 sheep and 3 sheep? 10 sheep and 4 sheep? 10 sheep and 5 sheep?

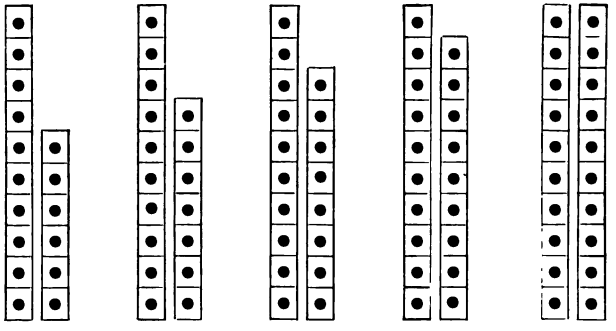
If you have 10 oranges, how many more must you buy to have 13? to have 14?

How many blocks must you add to 10 blocks to have 15? to have 12? to have 11?

How many twos are there in 8? in 10?

How many twos are there in 12? in 14?

TOPS.	BALLS.	CHICKENS.
$10 + 1 = ?$	$11 - 1 = ?$	$11 - 10 = ?$
$10 + 3 = ?$	$13 - 3 = ?$	$13 - 10 = ?$
$10 + 5 = ?$	$15 - 5 = ?$	$15 - 10 = ?$
$10 + 2 = ?$	$12 - 2 = ?$	$12 - 10 = ?$
$10 + 4 = ?$	$14 - 4 = ?$	$14 - 10 = ?$



How many dots are 10 dots and 6 dots? 10 dots and 7 dots? 10 dots and 8 dots? 10 dots and 9 dots? 10 dots and 10 dots?

If you have 10 cards, how many more must you have to make 16 cards? to make 17 cards?

How many marbles must you put with 10 marbles to make 19 marbles? to make 18 marbles?

How many cents have you if you have a ten-cent piece, a five-cent piece, and a one-cent piece?

10 cents + 5 cents + 1 cent = ?

How many cents have you if you have a ten-cent piece, a five-cent piece, and a two-cent piece?

CROWS.	CROWS.	CROWS.
10 + 7 = ?	17 − 7 = ?	17 − 10 = ?
10 + 9 = ?	19 − 9 = ?	19 − 10 = ?
10 + 6 = ?	16 − 6 = ?	16 − 10 = ?
10 + 8 = ?	18 − 8 = ?	18 − 10 = ?
10 + 10 = ?	20 − 10 = ?	15 − 10 = ?

Write under the number pictures below the figures for the number, and the name of the number.

In which place do we write the **ones**? the **tens**?

NOTE. Pupils should be made familiar with the dime and all coins of smaller value; and with the ten-cent postage stamp, and all stamps of smaller value.

Annie has 2 five-cent pieces and a one-cent piece. How much money has Annie? $2 \times 5 + 1 = ?$

What two pieces of money together make 11 cents? $10 + 1 = ?$

What two pieces of money together make 12 cents? $10 + 2 = ?$

What two pieces of money together make 15 cents? $10 + 5 = ?$

Alice has 2 five-cent pieces and a two-cent piece. How much money has Alice? $2 \times 5 + 2 = ?$

Harry has 3 five-cent pieces. How much money has Harry? $5 + 5 + 5 = ?$

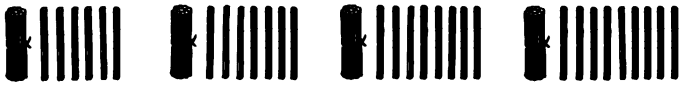
What five pieces of money together make 14 cents? $5 + 5 + 2 + 1 + 1 = ?$

What three pieces of money together make 13 cents? $10 + 2 + 1 = ?$

What four pieces of money together make 13 cents? $5 + 5 + 2 + 1 = ?$

What four pieces of money together make 14 cents? $5 + 5 + 2 + 2 = ?$

Write under the number pictures below the figures for the number, and the name of the number.



In which place do we write the **ones**? the **tens**?

How many tens and how many ones are there in 16? in 17? in 18? in 19?

How many ones must we add to 9 *ones* to make 1 *ten*? to 7 *ones* to make 1 *ten*? to 6 *ones* to make 1 *ten*? to 8 *ones* to make 1 *ten*?

How many tens and how many ones in 20?

What does the figure 0 mean in the number 20?

How many twos in 10? XX XX XX XX XX

How many fives in 10? XXXXX XXXXX

How many more twos in 16 than in 10? How many twos in 16?

How many more twos in 18 than in 10? How many twos in 18? How many twos in 12?

How many more ones in 19 than in 17?

How many more ones in 19 than in 16?

How many more ones in 19 than in 10?

How many more ones in 18 than in 10?

How many more ones in 16 than in 10?

How many more ones in 17 than in 10?

How many more ones in 18 than in 16?

How many more ones in 15 than in 10?

How many more ones in 15 than in 12?

Oral and slate exercises:

SHEEP.	LAMBS.	MEN.
12 + 2 = ?	11 + 2 = ?	13 + 3 = ?
11 + 4 = ?	15 + 2 = ?	14 + 3 = ?
14 + 5 = ?	13 + 4 = ?	12 + 6 = ?
16 + 3 = ?	14 + 2 = ?	17 + 1 = ?
12 + 4 = ?	12 + 5 = ?	11 + 8 = ?
13 + 6 = ?	11 + 7 = ?	15 + 3 = ?
15 + 4 = ?	17 + 2 = ?	13 + 5 = ?
18 + 1 = ?	12 + 3 = ?	11 + 3 = ?
12 + 7 = ?	11 + 6 = ?	14 + 4 = ?

EGGS.	HENS.	DUCKS.
17 − 1 = ?	15 − 3 = ?	14 − 2 = ?
13 − 2 = ?	19 − 4 = ?	18 − 6 = ?
19 − 5 = ?	19 − 7 = ?	16 − 5 = ?
16 − 2 = ?	14 − 2 = ?	19 − 4 = ?
19 − 6 = ?	17 − 3 = ?	18 − 4 = ?
14 − 3 = ?	19 − 2 = ?	16 − 4 = ?
15 − 2 = ?	17 − 4 = ?	19 − 8 = ?
17 − 5 = ?	18 − 5 = ?	17 − 2 = ?
16 − 3 = ?	19 − 3 = ?	18 − 1 = ?

NOTE. The above exercises, and similar exercises, should be worked aloud by *each one* of the class in turn; and on blocks of paper or slates. Thus, the first example should be worked at first, as follows: 12 sheep and 2 sheep are 14 sheep.

If a child makes a mistake, let the child himself correct it by the counting-board or by dots on the blackboard. Care should be taken to have him clearly see that the following operations are confined to the *ones*. Thus, in adding 2 to 12, let him fill the top row of holes in the counting-board with nails, and 2 holes more in the next row for the 12, then put 2 more nails in the row with the 2 nails already there. He will then see that 12 + 2 = 10 + 4 = 14.

How many cents are 12 cents and 5 cents?

How many days are 1 week and 3 days?

How many inches are 11 inches and 7 inches?

How many boys are 13 boys and 6 boys?

How many pinks are 15 pinks and 3 pinks?

One rose-bush has 17 roses, and another only 2. How many have both bushes together? How many more has one bush than the other?

A farmer has 16 cows in the barn, and 3 in the stable. How many cows has he in all? How many more in the barn than in the stable?

A man has 14 work horses and 2 driving horses. How many horses has he? How many more work horses than driving horses?

James found 15 eggs in one nest, and 5 in another. How many eggs did he find in both nests?

The number 12 is sometimes called a dozen.

When we say a *dozen eggs*, we mean *twelve* eggs.

Frank started with a dozen eggs from the barn, but dropped and broke two before he reached the house. How many did he carry into the house?

John has a dozen chickens of one kind, and 6 of another kind. How many has he of both kinds?

Harry had a dozen oranges, but he gave away ten. How many had he left?

A watch dealer had 3 dozen gold watches the week before Christmas; the day after Christmas he had 1 dozen left. How many dozen had he sold? How many watches had he left?

Oral and slate exercises:

CROWS.	ROBINS.
$9 + 3 = 10 + 2 = 12.$	$7 + 7 = 10 + 4 = 14.$
$9 + 8 = 10 + ? = ?$	$7 + 4 = 10 + ? = ?$
$9 + 4 = 10 + ? = ?$	$7 + 8 = 10 + ? = ?$
$9 + 6 = 10 + ? = ?$	$6 + 6 = 10 + ? = ?$
$9 + 5 = 10 + ? = ?$	$6 + 5 = 10 + ? = ?$
$9 + 7 = 10 + ? = ?$	$6 + 7 = 10 + ? = ?$
$9 + 2 = 10 + ? = ?$	$6 + 9 = 10 + ? = ?$
$9 + 9 = 10 + ? = ?$	$6 + 8 = 10 + ? = ?$
$8 + 3 = 10 + ? = ?$	$5 + 9 = 10 + ? = ?$
$8 + 5 = 10 + ? = ?$	$5 + 7 = 10 + ? = ?$
$8 + 7 = 10 + ? = ?$	$5 + 8 = 10 + ? = ?$
$8 + 6 = 10 + ? = ?$	$5 + 6 = 10 + ? = ?$
$8 + 4 = 10 + ? = ?$	$4 + 8 = 10 + ? = ?$
$8 + 8 = 10 + ? = ?$	$4 + 7 = 10 + ? = ?$
$8 + 9 = 10 + ? = ?$	$4 + 9 = 10 + ? = ?$
$7 + 5 = 10 + ? = ?$	$3 + 8 = 10 + ? = ?$

NOTE. When the sum of the ones is more than ten, we proceed as follows: Suppose we have to add 7 to 8. Call upon one of the children to put 8 nails in the top row of the counting-board, and 7 in the second row, and then ask, How many nails are there in the top row? How many holes are left? How many nails must we put in the top row to make ten? Let him take 2 nails from the 7 in the second row and put in the holes left in the top row. How many nails now in the top row? How many in the second row? Then 8 and 7 are 10 and 5, or 15.

Continue this practice, a few minutes at a time, until the children can dispense with the counting-board; then continue it with the intermediate step until they can dispense with that step, and name instantly the sum of any two numbers that are each less than ten.

This method may seem tedious, but it is the only method that gives *complete mastery of addition.*

Oral and slate exercises :

SPARROWS.

$8 + 6 = 10 + ? = ?$
$7 + 4 = 10 + ? = ?$
$5 + 8 = 10 + ? = ?$
$8 + 7 = 10 + ? = ?$
$9 + 3 = 10 + ? = ?$
$8 + 5 = 10 + ? = ?$
$6 + 5 = 10 + ? = ?$
$5 + 7 = 10 + ? = ?$
$4 + 9 = 10 + ? = ?$
$5 + 8 = 10 + ? = ?$
$7 + 6 = 10 + ? = ?$
$7 + 9 = 10 + ? = ?$

KINGBIRDS.

$4 + 7 = 10 + ? = ?$
$8 + 4 = 10 + ? = ?$
$7 + 8 = 10 + ? = ?$
$2 + 9 = 10 + ? = ?$
$9 + 4 = 10 + ? = ?$
$9 + 9 = 10 + ? = ?$
$8 + 8 = 10 + ? = ?$
$7 + 7 = 10 + ? = ?$
$6 + 6 = 10 + ? = ?$
$8 + 9 = 10 + ? = ?$
$3 + 9 = 10 + ? = ?$
$2 + 9 = 10 + ? = ?$

DUCKS.

$9 + 9 = ?$
$9 + 7 = ?$
$9 + 4 = ?$
$9 + 2 = ?$
$9 + 6 = ?$
$9 + 3 = ?$
$9 + 5 = ?$
$9 + 8 = ?$
$8 + 3 = ?$
$8 + 5 = ?$
$8 + 4 = ?$
$8 + 7 = ?$
$8 + 6 = ?$

TURKEYS.

$8 + 9 = ?$
$8 + 8 = ?$
$7 + 3 = ?$
$7 + 7 = ?$
$7 + 5 = ?$
$7 + 8 = ?$
$7 + 6 = ?$
$7 + 4 = ?$
$7 + 9 = ?$
$6 + 6 = ?$
$6 + 9 = ?$
$6 + 7 = ?$
$6 + 5 = ?$

CHICKENS.

$6 + 8 = ?$
$6 + 4 = ?$
$5 + 5 = ?$
$5 + 8 = ?$
$5 + 6 = ?$
$5 + 7 = ?$
$5 + 9 = ?$
$4 + 7 = ?$
$4 + 9 = ?$
$4 + 8 = ?$
$3 + 8 = ?$
$3 + 9 = ?$
$2 + 9 = ?$

How many days are 1 week and 4 days? 1 week and 5 days? 1 week and 6 days? 2 weeks?

John has 9 cents, and Mary 4 cents. How many have both? How many are 9 and 4? 4 and 9?

If one lamp is worth 6 dollars, and another 5 dollars, how much are both worth?

If there are 8 boys in one class, and 5 in another, how many are there in both classes?

If there are 6 boys in one class, and 7 in another, how many are there in both classes?

A farmer sold 6 sheep to one man, and 8 to another. How many sheep did he sell?

A farmer has 9 cows in one pasture, and 5 in another. How many cows has he in the two pastures? How many are 9 and 5? 5 and 9?

Tom has two hens, one white, and the other black. The white hen has 9 chickens, and the black hen has 8 chickens. How many chickens have both hens? How many are 9 and 8? 8 and 9?

James saw 9 crows on the ground, and 7 more flying about. How many crows did he see?

There are 8 blocks in one pile, and 8 in another pile. How many blocks are there in both piles?

There were 9 chickens roosting on one pole, and 6 on another pole. How many chickens were roosting on both poles? How many are 9 and 6?

If Harry paid 8 cents for his block of paper, and Ernest paid 7 cents for his, how many cents did the two blocks cost?

Oral and slate exercises :

CHAIRS.

$11 - 2 = 10 - 1 = 9.$
$11 - 3 = 10 - ? = ?$
$11 - 4 = 10 - ? = ?$
$11 - 5 = 10 - ? = ?$
$11 - 6 = 10 - ? = ?$
$11 - 7 = 10 - ? = ?$
$11 - 8 = 10 - ? = ?$
$11 - 9 = 10 - ? = ?$
$12 - 3 = 10 - ? = ?$
$12 - 4 = 10 - ? = ?$
$12 - 5 = 10 - ? = ?$
$12 - 6 = 10 - ? = ?$
$12 - 7 = 10 - ? = ?$
$12 - 8 = 10 - ? = ?$
$12 - 9 = 10 - ? = ?$
$13 - 4 = 10 - ? = ?$
$13 - 5 = 10 - ? = ?$
$13 - 6 = 10 - ? = ?$

BOXES.

$13 - 7 = 10 - 4 = 6.$
$13 - 8 = 10 - ? = ?$
$13 - 5 = 10 - ? = ?$
$14 - 5 = 10 - ? = ?$
$14 - 6 = 10 - ? = ?$
$14 - 7 = 10 - ? = ?$
$14 - 8 = 10 - ? = ?$
$14 - 9 = 10 - ? = ?$
$15 - 6 = 10 - ? = ?$
$15 - 7 = 10 - ? = ?$
$15 - 8 = 10 - ? = ?$
$15 - 9 = 10 - ? = ?$
$16 - 7 = 10 - ? = ?$
$16 - 8 = 10 - ? = ?$
$16 - 9 = 10 - ? = ?$
$17 - 8 = 10 - ? = ?$
$17 - 9 = 10 - ? = ?$
$18 - 9 = 10 - ? = ?$

NOTE. In teaching Subtraction, we may have the pupils use the knowledge acquired in Addition. Thus, if we wish to subtract 8 from 15, we may show them the answer sought is obtained by discovering the number that must be added to 8 to make 15. But it is better to teach Subtraction independent of Addition, by two steps, just as we did in Addition.

Suppose we are required to take 8 from 15. Let one of the children put 10 nails in the top row of holes in the counting-board, and 5 in the next row below. We now ask the following questions: How many nails must we take away to leave 10? How many more than 5 are we required to take away? And 3 nails from 10 nails leave? Then $15 - 8 = 10 - 3 = 7$.

Oral and slate exercises:

BUTTONS.	NEEDLES.	PINS.
12 − 3 =	14 − 8 =	11 − 6 =
13 − 6 =	12 − 6 =	15 − 7 =
11 − 5 =	11 − 3 =	13 − 4 =
15 − 9 =	16 − 8 =	13 − 7 =
16 − 7 =	13 − 9 =	12 − 5 =
13 − 8 =	15 − 8 =	11 − 8 =
11 − 7 =	17 − 9 =	14 − 7 =
12 − 9 =	11 − 2 =	12 − 8 =
15 − 6 =	12 − 7 =	16 − 9 =
14 − 6 =	14 − 5 =	18 − 9 =
11 − 4 =	12 − 4 =	13 − 5 =
11 − 9 =	16 − 8 =	14 − 9 =

If you pay 17 dollars for a table, and 8 dollars for a chair, how many dollars more do you pay for the table than for the chair?

John has 16 marbles, and James has 9. How many more has John than James?

Take 1 week from 14 days. How many days are left? How many weeks are left?

I have 17 miles to walk. After I have walked 9 miles, how many more have I to walk?

A milkman has 16 cows. If he sells 7, how many will be left?

A farmer had 16 turkeys, but a fox carried off 8 of them. How many were left for the farmer?

Alice has 15 chickens. If 6 are black, and the rest are white, how many are white?

If Ernest had 9 marbles more, he would have 15. How many marbles has he?

The first train in the morning had 7 cars, and the second train had 15 cars. How many more cars did the second train have than the first train?

Mary picked 15 quarts of blueberries, and George picked 8 quarts. How many more quarts did Mary pick than George?

George caught 14 trout, and his brother caught 8 trout. How many more did George catch than his brother?

Henry had 14 cents, but spent 6 cents for lemons. How many cents had he left?

Miriam is 14 years old. How old was she 7 years ago? 9 years ago?

Lucy's father and mother together gave her 14 cents. Her father gave her 9 cents. How many cents did her mother give her?

There were 14 rolls on the table before breakfast, and only 5 after breakfast. How many rolls were eaten at breakfast?

Frank had 13 cents. He had one five-cent piece, and the rest one-cent pieces. How many one-cent pieces did he have?

Mary's mother had 13 eggs. She used 4 for a pudding. How many were left?

How many are 14 less 6? 15 less 8? 13 less 9?

I sent by mail two books, and paid 13 cents postage. The postage for one was 8 cents. How much was the postage for the other?

A farmer had 13 lambs. How many had he left if he sold 6? if he sold 7?

Tom had 13 oranges, but he gave away 9. How many had he left?

Edna's class numbers 12. If 5 are boys, how many are girls?

Harry had 12 papers to sell. After he had sold 9, how many had he to sell?

Lucy had 12 plums, and Alice had 4. How many more had Lucy than Alice?

In two pods there were 12 peas. If there were 6 in one pod, how many were there in the other?

Erwin found a nest of 12 eggs. If he carried 3 of the eggs into the house, how many were left?

Fred had 12 cents. How many had he left if he spent 8 cents? if he spent 7 cents?

Jane bought 11 yards of ribbon, and used 6 yards. How many yards had she left?

Lucy is 11 years old, and Mary 7. How many years older is Lucy than Mary?

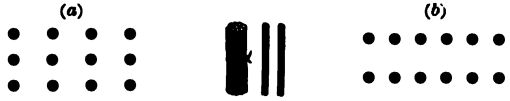
Frank bought 3 oranges for 9 cents, and sold them for 11 cents. How many cents did he gain?

Grace had 11 cents, and paid 5 cents for car-fare. How many cents had she left?

There were 11 saucers on the table, but 3 had no cups. How many had cups?

TWELVE. 12.

(*a*) (*b*)



Look at the number picture marked (*a*).
How many dots are there in each row?
How many rows are there?
How many dots in the three rows?
Then how many are 3 times 4 dots?

A line of dots running up and down the page is called a **column.**

How many dots in each column?
How many columns are there?
How many dots in the four columns?
Then how many are 4 times 3 dots?
How many 3's in 12? How many 4's in 12?

Look at the number picture marked (*b*).
How many dots are there in each row?
How many rows are there?
How many dots in the two rows?
Then how many are 2 times 6 dots?
How many dots are there in each column?
How many columns are there?
How many dots in the six columns?
Then how many are 6 times 2 dots?
How many 2's in 12? How many 6's in 12?
Find ½ of 12; ⅓ of 12; ¼ of 12; ⅙ of 12.

$12 \div 2 = ?$	$12 \div 3 = ?$	$12 \div 4 = ?$	$12 \div 6 = ?$
$2 \times 3 = ?$	$2 \times 4 = ?$	$2 \times 5 = ?$	$2 \times 6 = ?$
$3 \times 3 = ?$	$3 \times 4 = ?$	$4 \times 3 = ?$	$6 \times 2 = ?$

THE FOOT-RULE AND THE YARD-STICK.

Measure the yard-stick with the foot-rule. How many feet long is the yard-stick?

A carpet is a yard wide. How many feet wide is the carpet?

How many yards in 3 feet? in 6 feet? in 9 feet? in 12 feet?

How many feet in 2 yards? in 3 yards? in 4 yards? in $\frac{1}{3}$ of a yard?

If the distance between two windows is 3 yards, how many feet is the distance?

Your foot-rule is marked off into 12 divisions. What is each division called? How many inches, then, make a foot?

How many inches in $\frac{1}{2}$ a foot? $\frac{1}{3}$ of a foot? $\frac{1}{4}$ of a foot? $\frac{2}{3}$ of a foot? $\frac{3}{4}$ of a foot?

What part of a foot are 6 inches? 4 inches?

How many more inches are 10 inches than 6 inches? than 5 inches? than 3 inches? than 7 inches? than 2 inches?

Remember: 12 **inches make 1 foot.**
3 **feet make 1 yard.**

If 12 pounds of coffee are put up in packages of 4 pounds each, how many packages will there be?

If it takes $\frac{1}{2}$ of a dozen eggs for a pudding, how many eggs will it take for 2 puddings?

Edna's mother had a dozen eggs. She used $\frac{1}{4}$ of them for cake. How many eggs were left?

FOURTEEN. 14.

(a) (b)

Look at the number picture marked (*a*).

How many dots are there in each row?

How many rows are there?

How many dots in the two rows together?

How many dots, then, are 2 times 7 dots?

How many columns are there of 2 dots each?

How many dots in the seven columns?

How many dots, then, are 7 times 2 dots?

If you divide 14 dots into two equal numbers, how many will there be in each number?

$14 \div 2 = ?$ $\frac{1}{2}$ of $14 = ?$ $2 \times 7 = ?$ $7 \times 2 = ?$

Count by 2's to 14. How many 7's in 14?

How many skates are 7 pairs of skates?

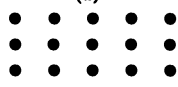
Alice has 7 two-cent pieces. How many apples at one cent each can she buy?

How many weeks do 14 days make?

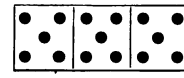
$2 \times 2 = ?$	$2 \times 5 = ?$	$4 \div 2 = ?$	$10 \div 5 = ?$
$2 \times 3 = ?$	$2 \times 6 = ?$	$6 \div 3 = ?$	$12 \div 2 = ?$
$2 \times 4 = ?$	$2 \times 7 = ?$	$8 \div 2 = ?$	$14 \div 7 = ?$
$8 + 4 = ?$	$6 + 5 = ?$	$9 + 5 = ?$	$8 + 9 = ?$
$9 + 6 = ?$	$7 + 6 = ?$	$5 + 7 = ?$	$8 + 5 = ?$
$7 + 8 = ?$	$9 + 4 = ?$	$6 + 9 = ?$	$7 + 9 = ?$
$14 - 8 = ?$	$17 - 8 = ?$	$14 - 5 = ?$	$16 - 7 = ?$
$15 - 7 = ?$	$14 - 9 = ?$	$13 - 6 = ?$	$13 - 7 = ?$
$16 - 9 = ?$	$13 - 5 = ?$	$12 - 7 = ?$	$18 - 9 = ?$

FIFTEEN. 15.

(a)



(b)



Look at the number picture marked (*a*).

How many dots are there in each row?

How many rows of dots are there?

How many dots in the three rows?

How many dots, then, are 3 times 5 dots?

How many dots are there in each column of dots?

How many columns of dots are there?

How many dots in the five columns?

How many dots, then, are 5 times 3 dots?

Look at the number picture marked (*b*).

How many sets of 5 each in 15?

Count by 3's to 15. Count by 5's to 15.

$15 \div 5 = ?$ $15 \div 3 = ?$ $\frac{1}{3}$ of $15 = ?$ $\frac{1}{5}$ of $15 = ?$

If one orange cost 3 cents, how many cents will 5 oranges cost? will 4 oranges cost?

How many pencils at a cent each can you buy with 3 five-cent pieces? with 2 five-cent pieces?

Find $\frac{1}{3}$ of 15 oranges; $\frac{1}{5}$ of 15 oranges.

Emily has 15 cents in five-cent pieces. How many five-cent pieces has she?

How many feet long is a string that is 5 yards long? 4 yards long? 3 yards long? 2 yards long?

What part of 15 pears are 5 pears? 3 pears?

How many inches are there in 1 foot and $\frac{1}{4}$ of a foot? in 1 foot and $\frac{1}{8}$ of a foot?

SIXTEEN. 16.

(a) (b)

Look at the number picture marked (*a*).
How many dots are there in each row?
How many rows are there?
How many dots in the four rows?
How many dots, then, are 4 times 4 dots?

Look at the number picture marked (*b*).
How many dots are there in each row?
How many rows are there?
How many dots in the two rows?
How many dots, then, are 2 times 8 dots?
How many columns of 2 dots each are there?
How many dots in the eight columns?
How many dots, then, are 8 times 2 dots?
Count by 2's to 16. Count by 4's to 16.
How many 2's in 16? How many 4's in 16?

$4 \times 4 = ?$	$2 \times 8 = ?$	$8 \times 2 = ?$	$16 \div 4 = ?$
$16 \div 2 = ?$	$16 \div 8 = ?$	$15 \div 3 = ?$	$15 \div 5 = ?$
$\frac{1}{2}$ of $16 = ?$	$\frac{1}{8}$ of $16 = ?$	$\frac{1}{4}$ of $16 = ?$	$\frac{1}{5}$ of $15 = ?$

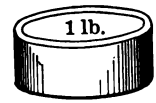
At 4 cents a quart, how many quarts of milk can you buy for 16 cents?

At 2 cents a pint, how many pints of milk can you buy for 16 cents?

At 8 cents a quart, how many quarts of berries can you buy for 16 cents?

LESSON 24.

OUNCES IN A POUND.



How many ounces make a pound?

It takes 16 ounces to make 1 pound.

How many ounces in ½ of a pound?

How many ounces in ¼ of a pound?

What part of a pound are 8 ounces?

What part of a pound are 4 ounces?

How many ounces in a quarter of a pound of tea?

How many ounces in a half of a pound of tea?

What will a pound of prunes cost, if half of a pound costs 8 cents?

What will a pound of raisins cost, if a quarter of a pound costs 4 cents?

If I buy three-quarters of a pound of candy, how many ounces of candy do I buy?

How many 4-ounce weights are equal to a pound weight? How many 8-ounce weights? How many 2-ounce weights? How many 1-ounce weights?

What part of a pound are 2 ounces? 4 ounces?

How many ½-ounce weights are equal to a 1-ounce weight? a 4-ounce weight? an 8-ounce weight?

If 1 egg weighs 2 ounces, how many eggs will it take to weigh a pound? a half-pound?

EIGHTEEN. 18.

How many dots in each row of dots marked (*a*)?
How many rows are there?
How many dots in the three rows?
How many dots, then, are 3 times 6 dots?
How many columns of dots are there?
How many dots in each column?
How many dots in the six columns?
How many dots, then, are 6 times 3 dots?
How many 6's in 18? How many 3's in 18?

Look at the dots marked (*b*).

How many dots in the top row? in the bottom row? in the two rows?

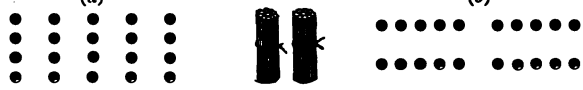
How many dots, then, are 2 times 9 dots?
How many columns of 2 dots each are there?
How many dots, then, are 9 times 2 dots?
How many 2's in 18? How many 9's in 18?
Count by 2's to 18. 2+2+2+2+2+2+2+2+2.
Count by 3's to 18. 3 + 3 + 3 + 3 + 3 + 3.
Count by 6's to 18. 6 + 6 + 6.

$2 \times 4 = ?$	$2 \times 5 = ?$	$2 \times 6 = ?$	$2 \times 7 = ?$
$2 \times 8 = ?$	$2 \times 9 = ?$	$18 \div 2 = ?$	$18 \div 3 = ?$
$18 \div 6 = ?$	$18 \div 9 = ?$	$9 + 9 = ?$	$18 - 9 = ?$
$\frac{1}{2}$ of $18 = ?$	$\frac{1}{3}$ of $18 = ?$	$\frac{1}{6}$ of $18 = ?$	$\frac{1}{9}$ of $18 = ?$

What part of 18 is 9? What part of 18 is 6?
What part of 18 is 3? What part of 18 is 2?

TWENTY. 20.

(*a*) (*b*)



How many dots in each row of dots marked (*a*)?
How many rows are there?
How many dots in the four rows?
How many dots, then, are 4 times 5 dots?
How many columns of dots are there?
How many dots in each column?
How many dots in the five columns?
How many dots, then, are 5 times 4 dots?
How many 5's in 20? How many 4's in 20?
Count by 4's to 20. Count by 5's to 20.

Look at the number picture marked (*b*).
How many dots in the top row?
How many dots in the bottom row?
How many dots in the two rows?
How many dots, then, are 2 times 10 dots?
How many columns of 2 dots each are there?
How many dots in the 10 columns?
How many dots, then, are 10 times 2 dots?
How many 10's in 20? How many 2's in 20?

$4 \times 5 = ?$ $5 \times 4 = ?$ $2 \times 10 = ?$ $10 \times 2 = ?$
$20 \div 4 = ?$ $20 \div 5 = ?$ $20 \div 2 = ?$ $20 \div 10 = ?$

Count by 2's to 19, beginning 1, 3, 5, etc.
Count by 3's to 19, beginning 1, 4, 7, etc.
Count by 3's to 20, beginning 2, 5, 8, etc.

ADDITION TABLE.

1	1	1	1	1	1	1	1	1	1
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—
2	2	2	2	2	2	2	2	2	2
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—
3	3	3	3	3	3	3	3	3	3
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—
4	4	4	4	4	4	4	4	4	4
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—
5	5	5	5	5	5	5	5	5	5
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—
6	6	6	6	6	6	6	6	6	6
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—
7	7	7	7	7	7	7	7	7	7
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—
8	8	8	8	8	8	8	8	8	8
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—
9	9	9	9	9	9	9	9	9	9
0	1	2	3	4	5	6	7	8	9
—	—	—	—	—	—	—	—	—	—

NOTE. The Teacher should copy this **addition table** on the board, and require *each pupil in turn* to name the sums as she touches the examples at random with a pointer. She should continue the drill daily until every pupil is absolutely certain of the required answer.

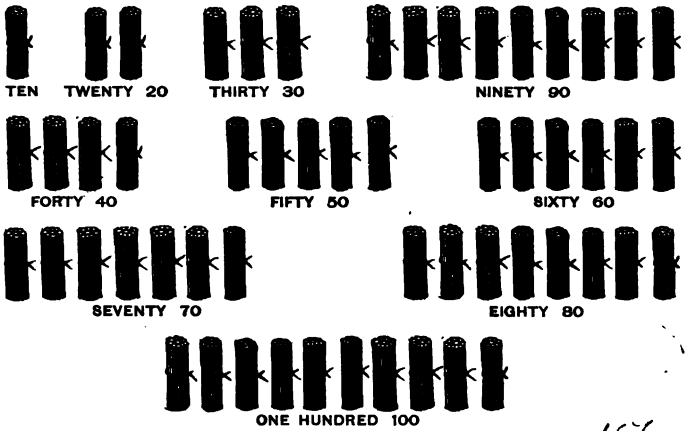
SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9	10
−1	−1	−1	−1	−1	−1	−1	−1	−1	−1
2	3	4	5	6	7	8	9	10	11
−2	−2	−2	−2	−2	−2	−2	−2	−1	−2
3	4	5	6	7	8	9	10	11	12
−3	−3	−3	−3	−3	−3	−3	−3	−3	−3
4	5	6	7	8	9	10	11	12	13
−4	−4	−4	−4	−5	−5	−5	−5	−5	−5
5	6	7	8	9	10	11	12	13	14
−5	−5	−5	−5	−5	−5	−5	−5	−5	−5
6	7	8	9	10	11	12	13	14	15
−6	−6	−6	−6	−6	−6	−6	−6	−6	−6
7	8	9	10	11	12	13	14	15	16
−7	−7	−7	−7	−7	−7	−7	−7	−7	−7
8	9	10	11	12	13	14	15	16	17
−8	−8	−8	−8	−8	−8	−8	−8	−8	−8
9	10	11	12	13	14	15	16	17	18
−9	−9	−9	−9	−9	−9	−9	−9	−9	−9
10	11	12	13	14	15	16	17	18	19
−10	−10	−10	−10	−10	−10	−10	−10	−10	−10

NOTE 1. Drill until each pupil can name the remainder the instant the pointer touches any of the following examples.

NOTE 2. Explain to the class that the sign − before a number shows that the number is to be taken away, or *subtracted.*

TENS.



What do we call 2 tens? 3 tens? 4 tens? 5 tens? 6 tens? 7 tens? 8 tens? 9 tens? 10 tens?

How many tens make ninety? thirty? one hundred? seventy? fifty? forty? sixty? eighty?

If I pay 6 ten-cent pieces for peaches, and 3 ten-cent pieces for pears, how many cents do I spend?

If I have 6 ten-cent pieces in one pocket, and 4 in another, how much money have I?

How many tens are 3 tens and 4 tens? 5 tens and 2 tens? 4 tens and 4 tens? 5 tens and 5 tens?

How many ten-cent pieces make a dollar?

Twenty is sometimes called a score.

How many years are 2 score years?

How old is a man who is 4 score years old?

How many years are 3 score and ten years?

Copy, and write the results:

20	20	50	70	30	60	50
+50	+60	+30	+20	+40	+30	+40
70	80	40	50	60	80	90
+30	+10	+40	+50	+40	+20	+10
50	60	70	80	90	30	50
−20	−30	−10	−50	−20	−20	−30
70	90	80	70	90	80	40
−30	−70	−40	−20	−30	−60	−20

$3 \times 20 = ?$	$2 \times 20 = ?$	$5 \times 10 = ?$
$4 \times 20 = ?$	$5 \times 20 = ?$	$5 \times 20 = ?$
$3 \times 30 = ?$	$2 \times 30 = ?$	$9 \times 10 = ?$
$4 \times 10 = ?$	$2 \times 40 = ?$	$10 \times 10 = ?$
$80 \div 4 = ?$	$60 \div 2 = ?$	$\frac{1}{2}$ of $40 = ?$
$20 \div 2 = ?$	$40 \div 4 = ?$	$\frac{1}{3}$ of $60 = ?$
$60 \div 3 = ?$	$80 \div 10 = ?$	$\frac{1}{4}$ of $80 = ?$
$90 \div 3 = ?$	$100 \div 10 = ?$	$\frac{1}{5}$ of $50 = ?$

You have already learned that we write the figure for the number of tens in the *second* place from the right. In what place, counting from the right, do we write the *hundreds* of a number?

Write on the board the number that contains six hundreds, no tens, and five ones.

If you rub out the 0, what does the number become?

Two tens and one make **twenty-one,** 21.
Two tens and two make **twenty-two,** 22.
Two tens and three make **twenty-three,** 23.
Two tens and four make **twenty-four,** 24.
Two tens and five make **twenty-five,** 25.
Two tens and six make **twenty-six,** 26.
Two tens and seven make **twenty-seven,** 27.
Two tens and eight make **twenty-eight,** 28.
Two tens and nine make **twenty-nine,** 29.

What are the names of the numbers made up of 3 tens and 1? 3 tens and 2? 3 tens and 3? 3 tens and 4? 3 tens and 5? 3 tens and 6? 3 tens and 7? 3 tens and 8? 3 tens and 9?

What are the names of the numbers made up of 4 tens and 1? 4 tens and 2? 4 tens and 3? 4 tens and 4? 4 tens and 5? 4 tens and 6? 4 tens and 7? 4 tens and 8? 4 tens and 9?

What are the names of the numbers made up of 5 tens and 1? 5 tens and 2? 5 tens and 3? 5 tens and 4? 5 tens and 5? 5 tens and 6? 5 tens and 7? 5 tens and 8? 5 tens and 9?

What are the names of the numbers made up of 6 tens and 1? 6 tens and 2? 6 tens and 3? 6 tens and 4? 6 tens and 5? 6 tens and 6? 6 tens and 7? 6 tens and 8? 6 tens and 9?

What are the names of the numbers made up of 7 tens and 1? 7 tens and 2? 7 tens and 3? 7 tens and 4? 7 tens and 5? 7 tens and 6? 7 tens and 7?

Read the numbers: 78; 79; 81; 82; 83; 84; 85; 86; 87; 88; 89.

Read the numbers: 91; 92; 93; 94; 95; 96; 97; 98; 99; 100; 200; 300; 400.

How many more tens has the number 84 than 72? 63 than 31? 55 than 15? 42 than 2? 95 than 80? 65 than 50? 94 than 43? 99 than 39?

Copy, and complete:

$18 = 10 + ?$	$26 = 2 \times 10 + ?$	$67 = 6 \times 10 + ?$
$14 = 10 + ?$	$37 = 3 \times 10 + ?$	$84 = 8 \times 10 + ?$
$13 = 10 + ?$	$24 = 2 \times 10 + ?$	$85 = 8 \times 10 + ?$
$19 = 10 + ?$	$35 = 3 \times 10 + ?$	$89 = 8 \times 10 + ?$
$12 = 10 + ?$	$39 = 3 \times 10 + ?$	$86 = 8 \times 10 + ?$
$15 = 10 + ?$	$41 = 4 \times 10 + ?$	$88 = 8 \times 10 + ?$
$16 = 10 + ?$	$47 = 4 \times 10 + ?$	$95 = 9 \times 10 + ?$
$17 = 10 + ?$	$43 = 4 \times 10 + ?$	$97 = 9 \times 10 + ?$
$11 = 10 + ?$	$55 = 5 \times 10 + ?$	$93 = 9 \times 10 + ?$
$20 = 10 + ?$	$59 = 5 \times 10 + ?$	$96 = 9 \times 10 + ?$
$50 = 10 + ?$	$51 = 5 \times 10 + ?$	$98 = 9 \times 10 + ?$
$70 = 10 + ?$	$52 = 5 \times 10 + ?$	$99 = 9 \times 10 + ?$

Copy, and add:

5	6	2	9	7	5	2	4	6	9
3	3	5	2	5	7	5	6	2	5
8	7	9	4	3	4	7	6	6	4
–	–	–	–	–	–	–	–	–	–
7	8	5	4	5	6	3	5	4	3
7	2	6	3	2	1	3	6	7	6
4	9	6	5	7	4	4	5	6	8
–	–	–	–	–	–	–	–	–	–

Copy, and add, adding the *ones* first:

22	31	33	25	18	35
21	33	11	21	30	11
23	12	13	11	21	21
32	23	31	22	20	22
34	60	40	41	36	23
12	17	25	34	21	22
30	12	13	13	20	32
13	10	11	10	12	11

Copy, and subtract, subtracting the *ones* first:

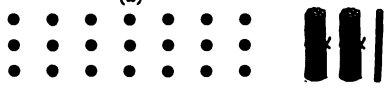
65	87	98	78	63	77
−43	−55	−67	−52	−51	−35
99	76	95	46	37	89
−44	−66	−54	−22	−21	−65
62	71	92	85	74	52
−40	−50	−70	−30	−43	−50

Copy, and multiply, multiplying the *ones* first:

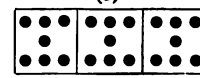
21	32	13	24	34	42
2	2	2	2	2	2
31	23	33	43	44	30
2	2	2	2	2	2
11	10	23	12	32	33
3	3	3	3	3	3
10	11	12	20	21	22
4	4	4	4	4	4

TWENTY-ONE. 21.

(*a*)



(*b*)



How many dots in each row of dots marked (*a*)?
How many rows of dots?
How many dots in the three rows together?
How many dots, then, are 3 times 7 dots?
How many dots in each column of dots?
How many columns of dots?
How many dots in the seven columns?
How many dots, then, are 7 times 3 dots?
How many 3's in 21?

Look at the number picture marked (*b*).
How many 7's in 21?

$3 \times 7 = ?$	$21 \div 3 = ?$	$\frac{1}{3}$ of $21 = ?$
$7 \times 3 = ?$	$21 \div 7 = ?$	$\frac{1}{7}$ of $21 = ?$

If a pair of boots costs 7 dollars, what will 3 pairs of boots cost? 2 pairs of boots?

If an orange costs 3 cents, what will 7 oranges cost? 6 oranges? 5 oranges? 4 oranges?

Divide 21 oranges equally among 3 boys. How many oranges will each boy have?

Divide 21 oranges equally among 7 boys. How many oranges will each boy have?

There are 21 apples in a basket, and James takes one-third of them. How many apples does he take?

If he had taken $\frac{1}{7}$ of them, how many would he have taken?

TWENTY-FOUR. 24.

How many dots in each row of dots marked (*a*)?
How many rows of dots?
How many dots in the three rows?
How many dots, then, are 3 times 8 dots?
How many dots in each column of dots?
How many columns are there?
How many dots in the eight columns?
How many dots, then, are 8 times 3 dots?

Look at the dots marked (*b*).
How many dots in each row?
How many rows of dots?
How many dots in the four rows?
How many dots, then, are 4 times 6 dots?
How many dots in each column of dots?
How many columns are there?
How many dots in the six columns?
How many dots, then, are 6 times 4 dots?

$3 \times 8 = ?$ $8 \times 3 = ?$ $4 \times 6 = ?$ $6 \times 4 = ?$

How many 3's in 24? How many 8's? How many 4's? How many 6's?

$24 \div 3 = ?$ $24 \div 4 = ?$ $24 \div 6 = ?$ $24 \div 8 = ?$

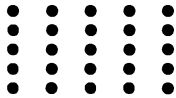
$\frac{1}{3}$ of $24 = ?$ $\frac{1}{4}$ of $24 = ?$ $\frac{1}{6}$ of $24 = ?$ $\frac{1}{8}$ of $24 = ?$

$4 \times 2 = ?$ $4 \times 3 = ?$ $4 \times 4 = ?$ $4 \times 5 = ?$ $4 \times 6 = ?$

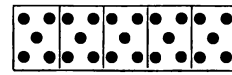
$5 \times 2 = ?$ $5 \times 3 = ?$ $5 \times 4 = ?$ $6 \times 3 = ?$ $6 \times 4 = ?$

TWENTY-FIVE. 25.

(*a*)



(*b*)



How many dots in each row of dots marked (*a*)?
How many rows are there?
How many dots in the five rows?
How many dots, then, are 5 times 5 dots?
How many 5's in 25? $\frac{1}{5}$ of 25 = ? $25 \div 5 = ?$
Count by 5's to 25? Count by 4's to 24.

NOTE. Assist the pupil by dots to count by 3's, 4's, etc., but only so long as such assistance is necessary.

Count by 3's to 24. Count by 2's to 24.
Count by 6's to 24. Count by 8's to 24.
Count by 3's to 25, beginning 1, 4, etc.
Count by 3's to 23, beginning 2, 5, etc.
Count by 4's to 25, beginning 1, 5, etc.
Count by 4's to 22, beginning 2, 6, etc.
Count by 4's to 23, beginning 3, 7, etc.

There are 5 plates in a row, and each plate has 5 apples on it. How many apples on the 5 plates?

If you divide 25 oranges equally among five little girls, how many oranges will each girl have?

If you have 25 oranges, how many times can you give away oranges if you give 5 each time?

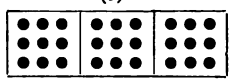
How many eggs make a dozen? a half-dozen?

How many inches make a foot? How many feet a yard? How many quarts a gallon?

TWENTY-SEVEN. 27.

(a)

(b)



How many dots in each row of dots marked (*a*)?
How many rows are there?
How many dots in the three rows together?
How many dots, then, are 3 times 9 dots?
How many dots in each column of dots?
How many columns are there?
How many dots in the nine columns?
How many dots, then, are 9 times 3 dots?
How many 3's in 27? How many 9's?
$27 \div 3 = ?$ $\frac{1}{3}$ of $27 = ?$ $27 \div 9 = ?$ $\frac{1}{9}$ of $27 = ?$

How many three-cent stamps can I buy for 27 cents? for 24 cents? for 21 cents?

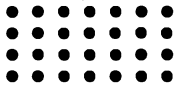
In one yard there are 3 feet. How many feet in 9 yards? in 8 yards? in 7 yards? in 6 yards?

At 9 cents a quart, how much will 3 quarts of berries cost? 2 quarts of berries?

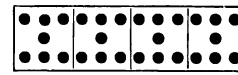
$2 \times 1 = ?$	$3 \times 1 = ?$	$4 \times 2 = ?$	$6 \times 2 = ?$
$2 \times 2 = ?$	$3 \times 2 = ?$	$4 \times 3 = ?$	$6 \times 3 = ?$
$2 \times 3 = ?$	$3 \times 3 = ?$	$4 \times 4 = ?$	$6 \times 4 = ?$
$2 \times 4 = ?$	$3 \times 4 = ?$	$4 \times 5 = ?$	$7 \times 2 = ?$
$2 \times 5 = ?$	$3 \times 5 = ?$	$4 \times 6 = ?$	$7 \times 3 = ?$
$2 \times 6 = ?$	$3 \times 6 = ?$	$5 \times 2 = ?$	$8 \times 2 = ?$
$2 \times 7 = ?$	$3 \times 7 = ?$	$5 \times 3 = ?$	$8 \times 3 = ?$
$2 \times 8 = ?$	$3 \times 8 = ?$	$5 \times 4 = ?$	$9 \times 2 = ?$
$2 \times 9 = ?$	$3 \times 9 = ?$	$5 \times 5 = ?$	$9 \times 3 = ?$

TWENTY-EIGHT. 28.

(a)



(b)



How many dots in each row of dots marked (*a*)?
How many rows are there?
How many dots in the four rows together?
How many dots, then, are 4 times 7 dots?
How many dots in each column?
How many columns of dots are there?
How many dots in the seven columns?
How many dots, then, are 7 times 4 dots?
How many 4's in 28? How many 7's in 28?
$4 \times 7 = ?$ $7 \times 4 = ?$ $28 \div 4 = ?$ $28 \div 7 = ?$

At 4 cents a quart, what will 6 quarts of milk cost? What will 7 quarts cost?

At 6 cents a quart, what will 4 quarts of berries cost? What will 3 quarts cost?

At 7 cents a quart, what will 4 quarts of berries cost? What will 3 quarts cost?

At 7 cents a cake, how many cakes of maple sugar can you buy for 28 cents?

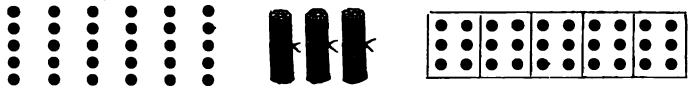
If it takes 4 men 7 days to dig a certain ditch, how long will it take 1 man to dig the ditch?

If it takes a man 28 days to build a certain wall, how many days will it take him to build a quarter of the wall? Three-quarters of the wall?

What part of 28 is 7? What part of 24 is 4? What part of 24 is 8? What part of 27 is 9?

THIRTY. 30.

(a) (b)



How many dots in each row of dots marked (*a*)?
How many rows are there?
How many dots in the five rows?
How many dots, then, are 5 times 6 dots?
How many dots in each column of dots?
How many columns of dots are there?
How many dots in the six columns?
How many dots, then, are 6 times 5 dots?
How many 6's in 30? How many 5's in 30?
What part of 30 is 6? What part of 30 is 5?
$5 \times 6 = ?$ $6 \times 5 = ?$ $30 \div 5 = ?$ $30 \div 6 = ?$
How many cents are 6 five-cent pieces?
How many five-cent stamps can you buy for 30 cents? for 25 cents? for 20 cents?
When berries are 6 cents a quart, how many quarts can you buy for 30 cents? for 24 cents?
How many more is $\frac{1}{5}$ of 30 than $\frac{1}{6}$ of 30?
How many tens in 30? How many tens in $\frac{1}{3}$ of 30? in $\frac{2}{3}$ of 30?
How many *sixths* of 30 must you take to have $\frac{1}{3}$ of 30? to have $\frac{1}{2}$ of 30?
How many *sixths* of any number must you take to have $\frac{1}{3}$ of the number? to have $\frac{1}{2}$ of the number?
How many inches in $\frac{1}{3}$ of a foot? in $\frac{2}{3}$ of a foot?
How many inches in $\frac{1}{2}$ of a foot? in $\frac{5}{6}$ of a foot?

SLATE ADDITION.

Add 8 ones to 6 tens and 7 ones.

Write the 6 tens and 7 ones 67
Then write the 8 ones under the 7 ones . . . 8
Add the ones. 75
How many are 8 ones and 7 ones? 15.
How many tens and how many ones in 15?
Write the 5 ones in the **ones'** place under 8.
What shall be done with the 1 ten?
Add it to the 6 tens, and we have 7 tens.
Now write the 7 tens in the **tens'** place.
Read the answer. How many tens and ones in 75?

Add 7 ones to 2 tens and 8 ones.
Add 8 ones to 2 tens and 5 ones.
Add 6 ones to 3 tens and 7 ones.
Add 4 ones to 4 tens and 9 ones.
Add 9 ones to 4 tens and 7 ones.
Add 5 ones to 5 tens and 5 ones.
Add 7 ones to 7 tens and 3 ones.

68	76	47	28	35	24
+8	+5	+6	+4	+8	+9
56	57	65	69	63	55
+4	+9	+7	+4	+8	+5
84	87	88	79	88	79
+7	+3	+9	+6	+8	+9
33	46	57	64	77	86
+7	+8	+7	+9	+9	+9

Add 3 tens and 7 ones to 4 tens and 6 ones.

Write the 4 tens and 6 ones 46
Then the 3 tens and 7 ones 37
Add the ones. 83

How many are 7 ones and 6 ones? 13.
How many tens and how many ones in 13?
Write the 3 ones in the **ones'** place under the 7.
What shall be done with the 1 ten in 13?
Add it to the tens.
1 ten and 3 tens are? and 4 tens more?
Write the 8 in the **tens'** place.
Read the answer. How many tens and ones in 83?
Add 5 tens and 3 ones to 1 ten and 8 ones.
Add 7 tens and 6 ones to 1 ten and 5 ones.
Add 3 tens and 7 ones to 3 tens and 6 ones.
Add 3 tens and 3 ones to 3 tens and 9 ones.
Add 2 tens and 5 ones to 5 tens and 5 ones.
Add 4 tens and 9 ones to 4 tens and 8 ones.
Add 6 tens and 4 ones to 1 ten and 9 ones.
Add 3 tens and 8 ones to 4 tens and 7 ones.

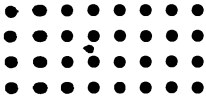
64	48	76	57	35	56
18	29	18	19	56	24
55	28	55	35	68	39
38	36	29	16	19	26
48	65	53	57	48	34
32	19	28	35	27	28

Add:

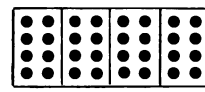
67	74	57	29	39	59
19	16	38	34	47	38
36	19	32	17	23	18
14	46	28	23	19	57
20	18	47	27	30	35
14	36	15	22	17	17
17	23	18	25	49	24
34	49	56	38	28	18
16	24	26	27	34	57
12	15	16	27	39	19
25	23	39	47	39	35
28	28	14	22	23	39
27	35	27	17	26	14
38	19	38	39	26	25
28	57	25	12	19	37
35	18	28	14	17	14
16	18	29	38	45	26
18	19	25	34	39	19
27	24	36	24	12	45
27	37	56	17	19	28
28	19	12	19	29	38
35	25	22	44	39	18

THIRTY-TWO. 32.

(*a*)



(*b*)



How many dots in each row of dots marked (*a*)?
How many rows of dots?
How many dots in the 4 rows?
How many dots, then, are 4 times 8 dots?
How many dots in each column of dots?
How many columns of dots are there?
How many dots in the eight columns?
How many dots, then, are 8 times 4 dots?

$4 \times 8 = ?$ $8 \times 4 = ?$ $32 \div 4 = ?$ $32 \div 8 = ?$

How many shoes will a blacksmith need to shoe 8 horses all round?

A teamster has 32 horses. How many four-horse teams can he form? How many eight-horse teams?

At 4 cents a quart, how many quarts of milk can you buy for 32 cents? for 28 cents?

At 8 cents a pint, how many pints of cream can you buy for 32 cents? for 24 cents?

Four weeks make a lunar month. How many weeks are there in 8 lunar months? in 7? in 6?

At 8 cents a pound, how much will 4 pounds of sugar cost? 3 pounds? 2 pounds?

How many pears in $\frac{1}{4}$ of 32 pears? in $\frac{1}{8}$ of 32 pears? in $\frac{1}{4}$ of 24 pears? in $\frac{1}{8}$ of 24 pears?

LESSON 44.

THE PECK.

NOTE. These wooden measures are used for measuring *dry* articles, such as oats, wheat, beans, potatoes, etc.

How many pints in one quart?

How many quarts make one peck? *

Eight quarts make one peck.

How many 2-quart measures of oats will a peck measure hold? How many 4-quart measures?

One quart of oats is what part of a peck of oats? Two quarts of oats are what part of a peck? four quarts?

How many quarts in 2 pecks? in 4 pecks?

If the peck measure is half-full of beans, how many more quarts of beans will it hold?

If the peck measure is a quarter-full of oats, how many more quarts will it hold?

If the peck measure is three-quarters full of cranberries, how many quarts of cranberries are in it? How many more quarts will it hold?

How many quarts in $\frac{1}{2}$ of a peck? in $\frac{1}{4}$ of a peck? in $\frac{3}{4}$ of a peck?

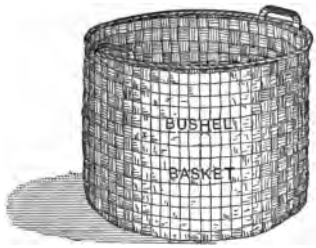
At 2 cents a quart, what will a peck of corn cost?

At 3 cents a quart, what will a peck of nuts cost?

At 4 cents a quart, what will a peck of peas cost?

* Let the pupil discover the answer *by trial.*

THE BUSHEL.



How many pints make a quart?

How many quarts make a peck?

How many pecks make a bushel?

Four pecks make one bushel.

How many pecks in a half-bushel?

One peck of corn is what part of a bushel of corn?

Two pecks are what part of a bushel? Three pecks are what part of a bushel?

How many quarts in a peck of berries?

How many quarts in a half-bushel of berries?

How many quarts in a bushel of berries?

How many quarts in three-quarters of a bushel?

In 24 quarts how many pecks?

In 32 quarts how many pecks?

If a bushel basket is half-full of apples, how many more pecks of apples will it hold?

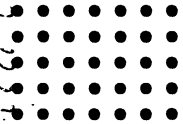
If a bushel basket is three-quarters full of apples, how many more pecks of apples will it hold?

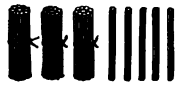
A bushel of oats weighs 32 pounds. How much does a peck weigh? How much do 4 quarts weigh?

What part of a bushel are 4 quarts? 8 quarts?

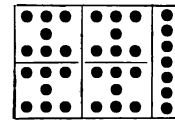
THIRTY-FIVE. 35.

(*a*)





(*b*)



How many dots in each row of dots marked (*a*)?
How many rows of dots?
How many dots in the five rows?
How many dots, then, are 5 times 7 dots?
How many dots in each column of dots?
How many columns of dots?
How many dots in the seven columns?
How many dots, then, are 7 times 5 dots?
How many 7's in 35? How many 5's in 35?

$5 \times 7 = ?$ $7 \times 5 = ?$ $35 \div 7 = ?$ $35 \div 5 = ?$

How many halves of a number make the entire number? How many thirds? How many fourths? How many fifths? How many sixths? How many sevenths?

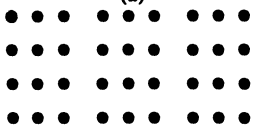
$\frac{1}{2}$ of 10 = ?	$\frac{1}{3}$ of 12 = ?	$\frac{1}{4}$ of 20 = ?
$\frac{1}{2}$ of 12 = ?	$\frac{1}{3}$ of 15 = ?	$\frac{1}{4}$ of 24 = ?
$\frac{1}{2}$ of 14 = ?	$\frac{1}{3}$ of 18 = ?	$\frac{1}{5}$ of 25 = ?
$\frac{1}{2}$ of 16 = ?	$\frac{1}{3}$ of 21 = ?	$\frac{1}{5}$ of 35 = ?
$\frac{1}{2}$ of 18 = ?	$\frac{1}{3}$ of 24 = ?	$\frac{1}{7}$ of 35 = ?

At seven dollars a cord, how many cords of wood can be bought for 35 dollars? for 21 dollars?

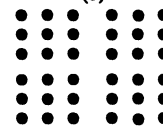
At 5 cents a ride, how many street-car rides can be taken for 35 cents? for 25 cents? for 15 cents?

THIRTY-SIX. 36.

(a)



(b)



How many dots in each row of dots marked (*a*)?
How many rows?
How many dots in the four rows?
How many dots, then, are 4 times 9 dots?
How many dots in each column of dots?
How many columns?
How many dots in the nine columns?
How many dots, then, are 9 times 4 dots?

How many dots in each row of dots marked (*b*)?
How many rows?
How many dots in the six rows?
How many dots, then, are 6 times 6 dots?

$4 \times 9 = ?$	$9 \times 4 = ?$	$6 \times 6 = ?$	$36 \div 4 = ?$
$36 \div 9 = ?$	$36 \div 6 = ?$	$\frac{1}{4}$ of $36 = ?$	$\frac{1}{6}$ of $36 = ?$

How many four-cent stamps can I buy for 36 cents? for 28 cents? for 32 cents? for 24 cents?

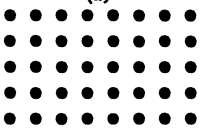
At 9 cents a yard, how many yards of calico can I buy for 36 cents? for 18 cents? for 27 cents?

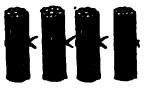
At 6 cents a quart, how many quarts of milk can I buy for 36 cents? for 24 cents? for 30 cents?

$4 \times 2 = ?$	$4 \times 4 = ?$	$4 \times 6 = ?$	$4 \times 8 = ?$
$4 \times 3 = ?$	$4 \times 5 = ?$	$4 \times 7 = ?$	$4 \times 9 = ?$

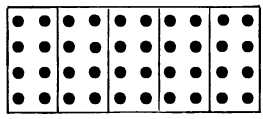
FORTY. 40.

(a)





(b)



How many dots in each row of dots marked (*a*)?
How many rows?
How many dots in the five rows?
How many dots, then, are 5 times 8 dots?
How many dots in each column of dots?
How many columns?
How many dots in the eight columns?
How many dots, then, are 8 times 5 dots?
How many 5's in 40? How many 8's in 40?

$5 \times 8 = ?$ $8 \times 5 = ?$ $40 \div 5 = ?$ $40 \div 8 = ?$

At 5 dollars a barrel, how many barrels of flour can you buy for 40 dollars? for 35 dollars?

At 8 cents a bottle, how many bottles of ink can you buy for 40 cents? for 32 cents?

If one loaf of bread is worth 5 cents, how many cents are 8 loaves worth? 6 loaves?

If a melon is worth 8 cents, how many cents are 5 melons worth? 4 melons?

How much will a boy earn in 9 weeks, if he earns 4 dollars a week?

$\frac{1}{5}$ of $20 = ?$	$\frac{1}{2}$ of $16 = ?$	$\frac{1}{8}$ of $16 = ?$
$\frac{1}{5}$ of $30 = ?$	$\frac{1}{4}$ of $32 = ?$	$\frac{1}{8}$ of $32 = ?$
$\frac{1}{5}$ of $40 = ?$	$\frac{1}{4}$ of $40 = ?$	$\frac{1}{8}$ of $40 = ?$

SLATE SUBTRACTION.

The result obtained from subtracting one number from another is called the **remainder** or **difference.**

From 5 tens and 3 ones take 2 tens and 8 ones.

Write the 5 tens and 3 ones 35
Write the 2 tens and 8 ones below 28
Draw a line underneath 25

We cannot take 8 ones from 3 ones. We therefore take 1 of the 5 tens and put with the 3 ones.

We now have 13 ones, and 8 ones from 13 ones leave 5 ones. We write the 5 in the **ones'** place under the 8.

As we have taken 1 ten from the 5 tens, we have only 4 tens left, and 2 tens from 4 tens leave 2 tens.

We write the 2 in the **tens'** place, and have for the remainder 2 tens and 5 ones; that is, 25.

NOTE. The entire work may be shown as follows:

53	40 + 13
28	20 + 8
25	20 + 5 = 25.

The pupils, however, must be taught from the first to do the work without any change of the figures.

75	23	33	31	37	86
−8	−4	−5	−3	−8	−7
67	35	37	32	46	82
−8	−9	−9	−7	−7	−3
56	36	32	41	43	81
−9	−7	−7	−6	−4	−4

Slate exercises:

75	42	33	64	83	92
− 37	− 25	− 16	− 28	− 38	− 29
50	41	42	56	35	52
− 29	− 24	− 15	− 27	− 26	− 28
48	42	62	55	61	72
− 19	− 29	− 33	− 27	− 37	− 36
70	52	85	75	85	60
− 37	− 39	− 16	− 36	− 28	− 48
98	96	73	86	83	57
− 69	− 27	− 57	− 69	− 27	− 18
74	67	85	91	80	61
− 37	− 19	− 38	− 64	− 55	− 28
64	73	81	80	43	82
− 45	− 26	− 33	− 43	− 26	− 57
94	72	91	80	51	90
− 18	− 19	− 29	− 37	− 22	− 23
87	95	93	90	73	83
− 19	− 26	− 38	− 43	− 37	− 35

Out of 16 eggs 7 were used for cooking. How many eggs were left?

In a class of 14 pupils there are 5 boys. How many girls are there in the class?

In a class of 13 pupils there are 6 girls. How many boys are there in the class?

Out of 15 signal flags, 8 are white, and the rest blue. How many flags are blue?

One package of tea weighs 16 ounces, and another weighs 8 ounces. How many more ounces in one package than in the other?

How much deeper is a well 21 feet deep than a well 18 feet deep?

How many more are 13 ducks than 9 ducks?

A man has 17 miles to go. After he has gone 9 miles, how many more has he to go?

From a board 16 inches long, a piece 9 inches long was cut off. How many inches long was the other piece?

A farmer had 13 lambs and sold 5 of them. How many had he left?

In a brood of 14 chickens 6 are white, and the rest brown. How many chickens are brown?

There were 13 crows on the ground. 7 flew away. How many were left on the ground?

What number must you add to 9 to get 12?

What number must you add to 3 to get 11?

What number must you take from 11 to get 5?

What number must you take from 14 to get 8?

The number 259 is read *two hundred fifty-nine*, and is composed of 2 hundreds, 5 tens, and 9 ones.

Read, and give the composition of the following numbers:

362	715	826	987	567
571	157	628	789	657
263	751	682	879	765
623	286	307	978	576
175	268	703	798	675
517	862	370	897	756

Write in figures the following numbers:

One hundred twenty-nine.	One hundred nine.
Two hundred thirty-six.	Seven hundred eight.
Two hundred twenty-four.	Five hundred six.
Two hundred twenty-two.	Four hundred seven.
Five hundred nineteen.	Three hundred five.
Seven hundred thirteen.	Two hundred four.
Six hundred eighteen.	Four hundred three.
Nine hundred eleven.	Three hundred two.
Three hundred twelve.	Four hundred one.
Three hundred sixteen.	Four hundred ten.

In any number composed of hundreds, tens, and ones,

The ones are called **units of the first order.**

The tens are called **units of the second order.**

The hundreds are called **units of the third order.**

Remember that **any standard** by which we count or measure is called a **unit.**

Find the sums:

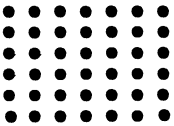
128	136	215	320	357
362	204	327	267	198
416	473	296	376	276
317	218	375	427	576
207	219	293	291	197
327	397	189	198	189
229	379	263	327	183
292	125	362	279	136
376	268	185	202	181

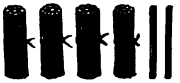
Find the remainders:

362	416	473	327	355
128	137	279	158	278
811	821	725	527	283
624	583	258	279	196
615	913	916	874	767
209	467	529	389	488
531	451	937	873	726
253	184	690	565	339
657	765	675	897	703
567	576	386	798	370
862	517	726	904	703
218	175	528	208	307

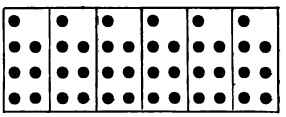
FORTY-TWO. 42.

(*a*)





(*b*)



How many dots in each row of dots marked (*a*)?
How many rows?
How many dots in the six rows?
How many dots, then, are 6 times 7 dots?
How many dots in each column of dots?
How many columns?
How many dots in the seven columns?
How many dots, then, are 7 times 6 dots?
How many 7's in 42? How many 6's in 42?

$6 \times 7 = ?$ $7 \times 6 = ?$ $42 \div 7 = ?$ $42 \div 6 = ?$

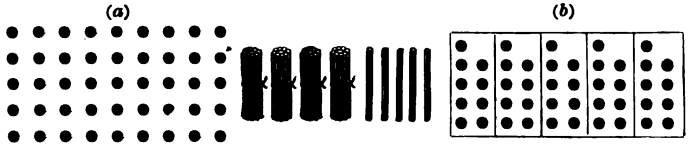
At 6 cents a pound, what will 7 pounds of sugar cost? 6 pounds? 5 pounds? 4 pounds?

At 7 cents a quart, how many quarts of blueberries can you buy for 42 cents?

At 6 dollars a ton, how many tons of coal can be bought for 42 dollars?

At 7 cents each, what will 6 melons cost?
Count by 2's to 42. Count by 3's to 42.
Count by 4's to 40. Count by 5's to 40.
Count by 6's to 42. Count by 7's to 42.
How many 7's in 28? 35? 42? 21? 14?
How many 6's in 24? 30? 36? 42? 18?
How many 5's in 25? 30? 35? 40? 20?

FORTY-FIVE. 45.



How many dots in each row of dots marked (*a*)?
How many rows?
How many dots in the five rows?
How many dots, then, are 5 times 9 dots?
How many dots in each column of dots?
How many columns?
How many dots in the nine columns?
How many dots, then, are 9 times 5 dots?
How many 9's in 45? How many 5's in 45?

$5 \times 9 = ?$ $9 \times 5 = ?$ $45 \div 5 = ?$ $45 \div 9 = ?$

At 5 cents a pound, how many pounds of sugar can be bought for 45 cents? for 40 cents?

At 9 cents a pound, how many pounds of candy can be bought for 45 cents? for 36 cents?

Copy, and write the products:

$2 \times 2 = ?$	$3 \times 2 = ?$	$4 \times 2 = ?$	$5 \times 2 = ?$
$2 \times 3 = ?$	$3 \times 3 = ?$	$4 \times 3 = ?$	$5 \times 3 = ?$
$2 \times 4 = ?$	$3 \times 4 = ?$	$4 \times 4 = ?$	$5 \times 4 = ?$
$2 \times 5 = ?$	$3 \times 5 = ?$	$4 \times 5 = ?$	$5 \times 5 = ?$
$2 \times 6 = ?$	$3 \times 6 = ?$	$4 \times 6 = ?$	$5 \times 6 = ?$
$2 \times 7 = ?$	$3 \times 7 = ?$	$4 \times 7 = ?$	$5 \times 7 = ?$
$2 \times 8 = ?$	$3 \times 8 = ?$	$4 \times 8 = ?$	$5 \times 8 = ?$
$2 \times 9 = ?$	$3 \times 9 = ?$	$4 \times 9 = ?$	$5 \times 9 = ?$

Copy, and write the quotients:

$4 \div 2 = ?$	$6 \div 3 = ?$	$8 \div 4 = ?$	$10 \div 5 = ?$
$6 \div 2 = ?$	$9 \div 3 = ?$	$12 \div 4 = ?$	$15 \div 5 = ?$
$8 \div 2 = ?$	$12 \div 3 = ?$	$16 \div 4 = ?$	$20 \div 5 = ?$
$10 \div 2 = ?$	$15 \div 3 = ?$	$20 \div 4 = ?$	$25 \div 5 = ?$
$12 \div 2 = ?$	$18 \div 3 = ?$	$24 \div 4 = ?$	$30 \div 5 = ?$
$14 \div 2 = ?$	$21 \div 3 = ?$	$28 \div 4 = ?$	$35 \div 5 = ?$
$16 \div 2 = ?$	$24 \div 3 = ?$	$32 \div 4 = ?$	$40 \div 5 = ?$
$18 \div 2 = ?$	$27 \div 3 = ?$	$36 \div 4 = ?$	$45 \div 5 = ?$
$20 \div 2 = ?$	$30 \div 3 = ?$	$40 \div 4 = ?$	$50 \div 5 = ?$

Find

$\frac{1}{2}$ of 4.	$\frac{1}{3}$ of 6.	$\frac{1}{4}$ of 8.	$\frac{1}{5}$ of 10.	$\frac{1}{6}$ of 12.
$\frac{1}{2}$ of 6.	$\frac{1}{3}$ of 9.	$\frac{1}{4}$ of 12.	$\frac{1}{5}$ of 15.	$\frac{1}{6}$ of 18.
$\frac{1}{2}$ of 8.	$\frac{1}{3}$ of 12.	$\frac{1}{4}$ of 16.	$\frac{1}{5}$ of 20.	$\frac{1}{6}$ of 24.
$\frac{1}{2}$ of 10.	$\frac{1}{3}$ of 15.	$\frac{1}{4}$ of 20.	$\frac{1}{5}$ of 25.	$\frac{1}{6}$ of 30.
$\frac{1}{2}$ of 12.	$\frac{1}{3}$ of 18.	$\frac{1}{4}$ of 24.	$\frac{1}{5}$ of 30.	$\frac{1}{6}$ of 36.
$\frac{1}{2}$ of 14.	$\frac{1}{3}$ of 21.	$\frac{1}{4}$ of 28.	$\frac{1}{5}$ of 35.	$\frac{1}{6}$ of 42.
$\frac{1}{2}$ of 16.	$\frac{1}{3}$ of 24.	$\frac{1}{4}$ of 32.	$\frac{1}{5}$ of 40.	$\frac{1}{7}$ of 42.
$\frac{1}{2}$ of 18.	$\frac{1}{3}$ of 27.	$\frac{1}{4}$ of 36.	$\frac{1}{5}$ of 45.	$\frac{1}{7}$ of 35.
$\frac{1}{2}$ of 20.	$\frac{1}{3}$ of 30.	$\frac{1}{4}$ of 40.	$\frac{1}{5}$ of 50.	$\frac{1}{7}$ of 28.

Find $\frac{2}{3}$ of 15; $\frac{3}{4}$ of 16; $\frac{2}{5}$ of 30; $\frac{3}{5}$ of 25; $\frac{2}{3}$ of 27; $\frac{3}{8}$ of 24; $\frac{3}{4}$ of 32; $\frac{4}{5}$ of 15; $\frac{2}{7}$ of 42; $\frac{5}{6}$ of 12.

Name two numbers whose product is: 15; 12; 18; 24; 21; 32; 28; 25; 35; 45; 42; 27; 20.

Name two *equal* numbers whose product is 16.

The product of two equal numbers is called a **square number.** Arrange 16 buttons in the form of a square.

Multiply 234 by 2.

Write the **multiplicand** 234
Under the *ones* write the **multiplier** 2
Draw a line below.
Multiply in order the *ones*, *tens*, and *hundreds*, and write the result at each step: Twice 4 ones are 8 ones, twice 3 tens are 6 tens, twice 2 hundreds are 4 hundreds. 468

The product, therefore, is 468.

Find the products:

342 × 2	123 × 2	243 × 2	334 × 2	321 × 2	424 × 2
123 × 3	132 × 3	323 × 3	213 × 3	312 × 3	212 × 3
111 × 4	112 × 4	121 × 4	211 × 4	212 × 4	222 × 4

Divide 648 by 2.

Write the **divisor** at the left of the **dividend** with a curved line between them, and draw a line underneath. 2)648
Divide in order the *hundreds*, *tens*, and *ones*, and write the result at each step: 2 in 6 hundreds, 3 hundreds; 2 in 4 tens, 2 tens; 2 in 8 ones, 4 ones. 324

The quotient, therefore, is 324.

Find the quotients:

2)642	2)246	2)264	2)624	2)842
2)428	2)684	2)468	2)864	2)248
3)369	3)639	3)396	3)693	3)936
3)963	4)444	4)484	4)448	4)844

LESSON 58.

ROMAN NUMERALS.

The Roman method of writing numbers uses these seven capital letters:

I = 1; V = 5; X = 10; L = 50;
C = 100; D = 500; M = 1000.

Other numbers are written by putting two or more of these letters together.

A letter written **before another of greater value** signifies the **difference** of the values of the letters used.

Thus, IV = 4; IX = 9; XL = 40; XC = 90.

A letter written **after another of the same or greater value** signifies the **sum** of the values of the letters used. Thus,

VI = 6; XI = 11; LX = 60; CX = 110;
II = 2; III = 3; VII = 7; VIII = 8;
XX = 20; XXX = 30; LXX = 70; CCC = 300.

Numbers from 10 to 20 are written:

11 = X + I = XI; 16 = X + VI = XVI;
12 = X + II = XII; 17 = X + VII = XVII;
13 = X + III = XIII; 18 = X + VIII = XVIII;
14 = X + IV = XIV; 19 = X + IX = XIX.
15 = X + V = XV;

In like manner:

25 = XX + V = XXV; 46 = XL + VI = XLVI;
29 = XX + IX = XXIX; 99 = XC + IX = XCIX.

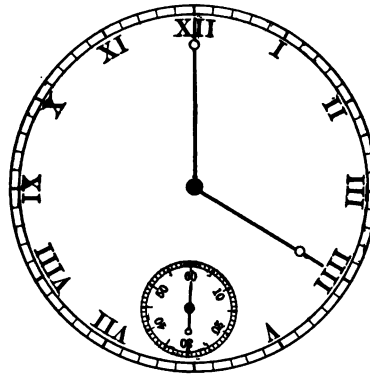
Complete with Roman numerals:

1 =	11 =	21 =	35 =	84 =
2 =	12 =	22 =	45 =	36 =
3 =	13 =	23 =	55 =	46 =
4 =	14 =	24 =	65 =	77 =
5 =	15 =	25 =	75 =	88 =
6 =	16 =	26 =	85 =	97 =
7 =	17 =	27 =	95 =	39 =
8 =	18 =	28 =	34 =	98 =
9 =	19 =	29 =	44 =	89 =
10 =	20 =	30 =	54 =	99 =

Complete with figures:

I =	XV =	XXIX =	XCIII =
II =	XVI =	XXX =	XCIV =
III =	XVII =	LI =	XCV =
IV =	XVIII =	LII =	XCVI =
V =	XIX =	LIII =	XCVII =
VI =	XX =	LIV =	XCVIII =
VII =	XXI =	LV =	XCIX =
VIII =	XXII =	LVI =	CXIX =
IX =	XXIII =	LVII =	CL =
X =	XXIV =	LVIII =	CLXX =
XI =	XXV =	LIX =	CVIII =
XII =	XXVI =	LX =	CCIX =
XIII =	XXVII =	XCI =	CCXX =
XIV =	XXVIII =	XCII =	CCXLV =

MEASURE OF TIME.



When the smallest hand of the clock has gone round the little circle, a *minute* has passed.

The little circle has 60 spaces, and the hand goes over one space every *second*. Hence,

Sixty seconds make a minute.

When the longest hand of the clock has gone round the large circle, an *hour* has passed.

How many spaces are marked on the large circle?

The longest hand goes over one space every *minute*. Hence,

Sixty minutes make an hour.

The letters I, II, etc., mark the hour spaces.

How many hours have passed when the hour-hand has gone entirely round the face of the clock?

The hour-hand goes round twice from sunrise to sunrise. Hence,

Twenty-four hours make a day.

How many minutes in a half of an hour? in a quarter of an hour? in a third of an hour? in three-quarters of an hour?

What part of an hour are 30 minutes? 15 minutes? 20 minutes? 10 minutes? 45 minutes?

How many hours in a half of a day? in a quarter of a day? in a third of a day?

What time of day is shown on the clock-face?

What time of day will be shown on the clock-face when the minute-hand reaches I? II? III? IIII? V? VI? VII? VIII? IX? X? XI? XII?

What time of day will be shown on the clock-face when the minute-hand is one minute-space beyond I? II? III? V? VI? VIII? IX? X? XI?

What time of day will be shown on the clock-face when the minute-hand is two minute-spaces beyond I? II? III? IIII? VI? IX? X? XI?

What time of day will be shown on the clock-face when the minute-hand is three minute-spaces beyond I? III? V? VII? IX? X? XI?

What time of day will be shown on the clock-face when the minute-hand is four minute-spaces beyond II? III? V? VI? VII? VIII? IX? X?

What time of day will be shown on the clock-face when the minute-hand is at XII and the hour-hand at I? II? III? V? VI? VII? VIII? IX?

At what letters does the minute-hand point at half-past four? at quarter-past four? at quarter of five? at 20 minutes to five?

If a man works 8 hours a day, what part of the day (24 hours) does he work?

What part of 24 hours are 4 hours? 6 hours? 8 hours? 12 hours? 2 hours?

If a man can dig one-quarter of a certain ditch in 8 hours, how many hours will it take him to dig the whole ditch?

If 2 men can mow a certain field in 8 days, how many days will it take one man to mow it?

If one man can mow a certain field in 24 days, how many men will it take to mow the field in 6 days? in 4 days? in 8 days? in 3 days?

How many minutes are there in 2 hours? in 3 hours? in 4 hours? in 5 hours? in 6 hours?

How many seconds are there in 2 minutes? in 4 minutes? in 5 minutes? in 6 minutes?

What part of a minute are 30 seconds? 15 seconds? 12 seconds? 20 seconds? 40 seconds? 45 seconds? 50 seconds?

If a man walks a mile in 20 minutes, how many miles at that rate will he walk in an hour?

If a man walks a mile in 15 minutes, how many miles at that rate will he walk in an hour?

At the rate of one mile in 10 minutes, how many miles will a horse go in an hour?

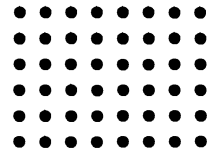
At the rate of one mile in 6 minutes, how many miles will a horse go in one hour?

At the rate of one mile in 2 minutes, how many miles will a railway train go in an hour?

Part III.

LESSON 1.

FORTY-EIGHT. 48.



How many dots are there in each row?
How many rows are there?
How many dots in the six rows?
How many dots, then, are 6 times 8 dots?
How many dots are there in each column?
How many columns are there?
How many dots in the eight columns?
How many dots, then, are 8 times 6 dots?

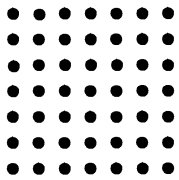
$6 \times 8 = ?$	$8 \times 6 = ?$	$48 \div 8 = ?$	$48 \div 6 = ?$
$\frac{1}{6}$ of 48 = ?	$\frac{1}{8}$ of 48 = ?	$\frac{1}{4}$ of 48 = ?	$\frac{1}{3}$ of 48 = ?

At 6 dollars a ton, what will 8 tons of coal cost?

At 8 dollars apiece, what will 6 hats cost?

If a cow gives 8 quarts of milk a day, in how many days will she give 48 quarts?

FORTY-NINE. 49.



How many dots are there in each row?
How many rows are there?
How many dots in the seven rows?
How many dots, then, are 7 times 7 dots?
Count by 7's to 49. Count by 8's to 48.

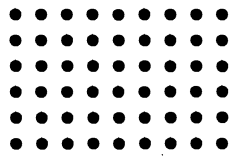
$7 \times 7 = ?$	$49 \div 7 = ?$	$\frac{1}{7}$ of $49 = ?$	$2 \times 7 = ?$
$3 \times 7 = ?$	$4 \times 7 = ?$	$5 \times 7 = ?$	$6 \times 7 = ?$
$7 + 7 = ?$	$49 - 7 = ?$	$42 - 7 = ?$	$35 - 7 = ?$
$28 - 7 = ?$	$21 - 7 = ?$	$14 - 7 = ?$	$7 - 7 = ?$

At 7 cents a pound, what will 7 pounds of rice cost? 6 pounds? 5 pounds? 4 pounds? 3 pounds?

Copy and subtract:

418	219	607	729	839
−166	−184	−235	−327	−655
905	806	704	603	502
−461	−235	−194	−152	−171
213	314	415	516	617
−151	−182	−193	−264	−255
526	425	324	635	639
−275	−283	−193	−383	−379

FIFTY-FOUR. 54.



How many dots are there in each row?
How many rows are there?
How many dots in the six rows?
How many dots, then, are 6 times 9 dots?
How many dots are there in each column?
How many columns are there?
How many dots in the nine columns?
How many dots, then, are 9 times 6 dots?
Count by 6's to 54. Count by 9's to 54.

$6 \times 9 = ?$	$9 \times 6 = ?$	$54 \div 6 = ?$	$54 \div 9 = ?$
$\frac{1}{2}$ of $54 = ?$	$\frac{1}{3}$ of $54 = ?$	$\frac{1}{6}$ of $54 = ?$	$\frac{1}{9}$ of $54 = ?$
$2 \times 6 = ?$	$6 \times 6 = ?$	$12 \div 6 = ?$	$36 \div 6 = ?$
$3 \times 6 = ?$	$7 \times 6 = ?$	$18 \div 6 = ?$	$42 \div 6 = ?$
$4 \times 6 = ?$	$8 \times 6 = ?$	$24 \div 6 = ?$	$48 \div 6 = ?$
$5 \times 6 = ?$	$9 \times 6 = ?$	$30 \div 6 = ?$	$54 \div 6 = ?$

How many tens and how many ones in 54?

$54 - 6 = ?$	$48 - 6 = ?$	$42 - 6 = ?$	$36 - 6 = ?$
$30 - 6 = ?$	$24 - 6 = ?$	$18 - 6 = ?$	$12 - 6 = ?$
$54 - 9 = ?$	$45 - 9 = ?$	$36 - 9 = ?$	$27 - 9 = ?$

At 6 cents a quart, what will 9 quarts of milk cost? 8 quarts? 7 quarts? 6 quarts? 4 quarts?

At 9 cents a pint, what will 6 pints of sirup cost? 5 pints? 4 pints? 3 pints? 2 pints?

If we divide 25 by 4, we have 6 for the quotient and 1 for the remainder.

The quotient and remainder may be written as a complete quotient, thus, $6\frac{1}{4}$.

In this quotient, the part $\frac{1}{4}$ is written by writing the remainder above the divisor with a line between them.

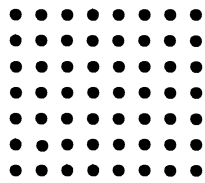
Divide, and write the complete quotient under the dividend in each case:

2) 13	3) 20	3) 29	5) 21	6) 13
2) 15	3) 22	4) 21	5) 27	5) 32
2) 17	3) 23	4) 23	5) 33	6) 39
2) 19	3) 25	4) 33	5) 34	6) 40
3) 19	3) 26	4) 35	5) 37	6) 47
3) 17	3) 28	4) 37	5) 44	6) 53

---

2) 123	3) 123	4) 124	6) 126
2) 143	3) 153	4) 128	6) 128
2) 167	3) 157	4) 160	6) 186
2) 165	3) 159	4) 166	6) 180
2) 169	3) 127	4) 168	6) 248
2) 182	3) 128	4) 204	6) 249
2) 184	3) 187	4) 247	6) 306
2) 187	3) 189	4) 289	6) 368

FIFTY-SIX. 56.



How many dots are there in each row?
How many rows are there?
How many dots in the seven rows?
How many dots, then, are 7 times 8 dots?
How many dots in each column?
How many columns are there?
How many dots in the eight columns?
How many dots, then, are 8 times 7 dots?

$7 \times 8 = ?$ $8 \times 7 = ?$ $56 \div 7 = ?$ $56 \div 8 = ?$
$\frac{1}{7}$ of $56 = ?$ $\frac{1}{8}$ of $56 = ?$ $\frac{1}{4}$ of $56 = ?$ $\frac{1}{2}$ of $56 = ?$

How many *eighths* of 56 are equal to $\frac{1}{4}$ of 56?
How many *eighths* of 56 are equal to $\frac{1}{2}$ of 56?
How many *fourths* of 56 are equal to $\frac{1}{2}$ of 56?
Count by 8's to 56. Count by 7's to 56.

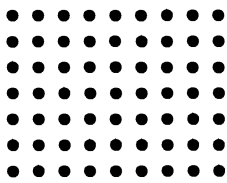
If a man works 8 hours a day, how many hours will he work in 5 days? in 6 days? in 7 days?

What will 7 yards of print cost, at 8 cents a yard? at 7 cents a yard? at 6 cents a yard?

At 8 cents a yard, how many yards of cambric can be bought for 40 cents? for 48 cents?

At 7 dollars a ton, how many tons of coal can be bought for 49 dollars? for 56 dollars?

SIXTY-THREE. 63.



How many dots are there in each row?
How many rows are there?
How many dots in the seven rows?
How many dots, then, are 7 times 9 dots?
How many dots are there in each column?
How many columns are there?
How many dots in the nine columns?
How many dots, then, are 9 times 7 dots?

$7 \times 9 = ?$ $9 \times 7 = ?$ $63 \div 7 = ?$ $63 \div 9 = ?$
$\frac{1}{7}$ of $63 = ?$ $\frac{1}{9}$ of $63 = ?$ $\frac{1}{8}$ of $63 = ?$ $\frac{2}{8}$ of $63 = ?$

How many *ninths* of 63 are equal to $\frac{1}{8}$ of 63?
Count by 7's to 63. Count by 9's to 63.
At 9 cents a foot, what will 7 feet of lead pipe cost? 6 feet? 4 feet? 5 feet? 3 feet?
How many days are there in 9 weeks?
At 7 dollars a week, how many weeks' board can be had for 56 dollars? for 63 dollars?
At 9 cents a quart, how many quarts of cranberries can be bought for 54 cents? for 63 cents?
How many quarts of oats in 7 pecks of oats?
How many dozen eggs in 48 eggs?
How many gallons of milk in 36 quarts of milk?

$7 \times 2 = ?$	$7 \times 6 = ?$	$14 \div 7 = ?$	$42 \div 7 = ?$
$7 \times 3 = ?$	$7 \times 7 = ?$	$21 \div 7 = ?$	$49 \div 7 = ?$
$7 \times 4 = ?$	$7 \times 8 = ?$	$28 \div 7 = ?$	$56 \div 7 = ?$
$7 \times 5 = ?$	$7 \times 9 = ?$	$35 \div 7 = ?$	$63 \div 7 = ?$

Copy, and find the products:

12	12	11	11	11	11	11
3	4	5	6	7	8	9
—	—	—	—	—	—	—
41	41	41	41	41	41	41
3	4	5	6	7	8	9
—	—	—	—	—	—	—
60	60	60	60	60	60	60
3	4	5	6	7	8	9
—	—	—	—	—	—	—
31	31	31	31	31	31	31
3	4	5	6	7	8	9
—	—	—	—	—	—	—
70	70	70	70	70	70	70
3	4	5	6	7	8	9
—	—	—	—	—	—	—
80	80	80	80	80	50	60
3	4	5	6	7	8	9
—	—	—	—	—	—	—
91	91	91	91	91	71	61
3	4	5	6	7	8	9
—	—	—	—	—	—	—
80	80	80	80	80	80	80
3	4	5	6	7	8	9
—	—	—	—	—	—	—
81	71	61	91	51	41	31
7	8	9	6	8	7	6
—	—	—	—	—	—	—

A fly has 6 legs. How many legs have 9 flies?

A spider has 8 legs. How many legs have 7 spiders? 6 spiders? 4 spiders? 3 spiders?

An ox has 8 hoofs. How many hoofs have 6 oxen? 5 oxen? 4 oxen? 3 oxen?

A man bought 9 cords of wood at 4 dollars a cord, and gave 4 ten-dollar bills in payment. How much change should he receive?

James had 7 cents, and his father gave him six times as much. How many cents had he then?

Ernest has 9 five-cent pieces and 3 cents. How much money has he?

What will 9 sheep cost, at 6 dollars each?

At 7 cents a yard, what will 9 yards of cotton cloth cost? What will 8 yards cost?

A farmer sold 9 lambs for 45 dollars. How much apiece did he get for them?

How many lengths of 9 yards each can be cut from a piece of silk 63 yards long?

In a schoolroom there were 63 seats arranged in 7 rows. How many seats in each row?

Find the cost of a dozen peaches at 3 for 5 cents.

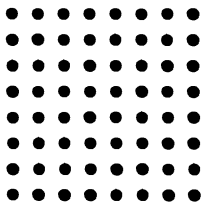
Find the cost of a dozen pears at 3 for 4 cents.

A bushel of oats weighs 32 pounds. How many pounds will a peck weigh? 3 pecks?

A bushel of corn weighs 56 pounds. How many pounds will a peck weigh? 2 pecks?

At 56 cents a peck, how much must be paid for a quart of beans? 2 quarts? 4 quarts? 6 quarts?

SIXTY-FOUR. 64.



How many dots are there in each row?
How many rows are there?
How many dots in the eight rows?
How many dots, then, are 8 times 8 dots?
Count by 8's to 64.

$8 \times 8 = ?$ $64 \div 8 = ?$ $\frac{1}{8}$ of $64 = ?$

A man receives 8 dollars a week for work. How much does he receive in 8 weeks?

There are 8 pints in a gallon. How many pints are there in 8 gallons? in 7 gallons?

When flour is 6 dollars a barrel, what will 8 barrels cost? 9 barrels? 7 barrels? 4 barrels?

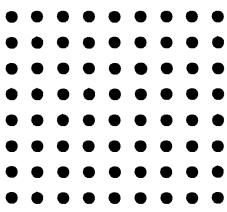
When blueberries are 8 cents a quart, what will 7 quarts cost? 8 quarts? 6 quarts? 5 quarts?

At 7 cents a quart, what will a peck of beans cost? What will 9 quarts cost? What will 6 quarts cost? What will 4 quarts cost?

If a freight train averages 8 miles an hour, in how many hours will it run 64 miles? 56 miles?

$64 - 8 = ?$ $56 - 8 = ?$ $48 - 8 = ?$ $40 - 8 = ?$
$32 - 8 = ?$ $24 - 8 = ?$ $16 - 8 = ?$ $8 - 8 = ?$

SEVENTY-TWO. 72.



How many dots are there in each row?
How many rows are there?
How many dots in the eight rows?
How many dots, then, are 8 times 9 dots?
How many dots are there in each column?
How many columns are there?
How many dots in the nine columns?
How many dots, then, are 9 times 8 dots?

$8 \times 9 = ?$ $9 \times 8 = ?$ $72 \div 8 = ?$ $72 \div 9 = ?$
$\frac{1}{8}$ of $72 = ?$ $\frac{1}{9}$ of $72 = ?$ $\frac{1}{8}$ of $72 = ?$ $\frac{1}{4}$ of $72 = ?$

At 8 dollars apiece, what will be the cost of 9 calves? 7 calves? 8 calves? 6 calves?

At 9 cents a yard, what will be the cost of 8 yards of cambric? 7 yards? 6 yards?

A farmer sold 8 calves for 72 dollars. How much did he get apiece?

If 9 yards of muslin cost 72 cents, what is the price of the muslin a yard?

How many 9's in 36? in 54? in 63? in 45? in 72? in 27? in 18?

How many dozen in 24? in 36? in 48? in 72?

$2 \times 8 = ?$	$6 \times 8 = ?$	$16 \div 2 = ?$	$48 \div 6 = ?$
$3 \times 8 = ?$	$7 \times 8 = ?$	$24 \div 3 = ?$	$56 \div 7 = ?$
$4 \times 8 = ?$	$8 \times 8 = ?$	$32 \div 4 = ?$	$64 \div 8 = ?$
$5 \times 8 = ?$	$9 \times 8 = ?$	$40 \div 5 = ?$	$72 \div 9 = ?$

$\frac{1}{8}$ of $16 = ?$	$\frac{1}{8}$ of $32 = ?$	$\frac{1}{8}$ of $48 = ?$	$\frac{1}{8}$ of $64 = ?$
$\frac{1}{2}$ of $16 = ?$	$\frac{1}{4}$ of $32 = ?$	$\frac{1}{6}$ of $48 = ?$	$\frac{1}{4}$ of $64 = ?$
$\frac{1}{3}$ of $24 = ?$	$\frac{1}{5}$ of $40 = ?$	$\frac{1}{8}$ of $56 = ?$	$\frac{1}{8}$ of $72 = ?$
$\frac{1}{3}$ of $24 = ?$	$\frac{1}{5}$ of $40 = ?$	$\frac{1}{7}$ of $56 = ?$	$\frac{1}{9}$ of $72 = ?$

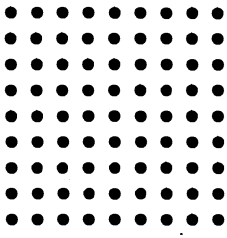
Add:

23	31	27	36	47	75
35	49	33	67	51	24
47	36	29	73	68	37
72	53	32	21	33	22
—	—	—	—	—	—
36	67	76	89	98	57
84	74	88	37	65	84
39	38	31	53	29	37
46	21	19	27	37	18
—	—	—	—	—	—

Find the differences:

225	313	321	337	235
87	56	28	89	88
—	—	—	—	—
312	482	563	671	817
147	279	392	289	465
—	—	—	—	—
476	567	675	576	637
279	378	387	378	239
—	—	—	—	—

EIGHTY-ONE. 81.



How many dots are there in each row?

How many rows are there?

How many dots in the nine rows?

How many dots, then, are 9 times 9 dots?

Count by 9's to 81. $9 \times 9 = ?$ $81 \div 9 = ?$

If it takes 9 yards of cloth for a dress, how many yards will be required for 9 dresses?

If a family uses 9 pounds of sugar a week, how many weeks will 81 pounds last the family?

If it takes 7 eggs for a cake, how many eggs will be required for 9 cakes?

How many days are there in 9 weeks?

If it takes 9 yards of print for a dress, how many dresses can be made from 54 yards?

If you sleep 8 hours every night, how many hours will you sleep in 9 nights?

$2 \times 9 = ?$	$6 \times 9 = ?$	$18 \div 9 = ?$	$54 \div 9 = ?$
$3 \times 9 = ?$	$7 \times 9 = ?$	$27 \div 9 = ?$	$63 \div 9 = ?$
$4 \times 9 = ?$	$8 \times 9 = ?$	$36 \div 9 = ?$	$72 \div 9 = ?$
$5 \times 9 = ?$	$9 \times 9 = ?$	$45 \div 9 = ?$	$81 \div 9 = ?$

MULTIPLICATION TABLE.

2 TIMES	3 TIMES	4 TIMES	5 TIMES
1 ARE 2	1 ARE 3	1 ARE 4	1 ARE 5
2 ARE 4	2 ARE 6	2 ARE 8	2 ARE 10
3 ARE 6	3 ARE 9	3 ARE 12	3 ARE 15
4 ARE 8	4 ARE 12	4 ARE 16	4 ARE 20
5 ARE 10	5 ARE 15	5 ARE 20	5 ARE 25
6 ARE 12	6 ARE 18	6 ARE 24	6 ARE 30
7 ARE 14	7 ARE 21	7 ARE 28	7 ARE 35
8 ARE 16	8 ARE 24	8 ARE 32	8 ARE 40
9 ARE 18	9 ARE 27	9 ARE 36	9 ARE 45

6 TIMES	7 TIMES	8 TIMES	9 TIMES
1 ARE 6	1 ARE 7	1 ARE 8	1 ARE 9
2 ARE 12	2 ARE 14	2 ARE 16	2 ARE 18
3 ARE 18	3 ARE 21	3 ARE 24	3 ARE 27
4 ARE 24	4 ARE 28	4 ARE 32	4 ARE 36
5 ARE 30	5 ARE 35	5 ARE 40	5 ARE 45
6 ARE 36	6 ARE 42	6 ARE 48	6 ARE 54
7 ARE 42	7 ARE 49	7 ARE 56	7 ARE 63
8 ARE 48	8 ARE 56	8 ARE 64	8 ARE 72
9 ARE 54	9 ARE 63	9 ARE 72	9 ARE 81

Copy and multiply:

94 × 2	43 × 3	62 × 4	51 × 5	71 × 7	81 × 8
71 × 9	91 × 8	81 × 7	61 × 6	31 × 5	92 × 4
920 × 3	930 × 2	610 × 9	710 × 8	910 × 7	810 × 6
210 × 9	310 × 8	710 × 7	910 × 6	810 × 5	920 × 4
622 × 4	911 × 5	711 × 6	911 × 7	811 × 8	911 × 9
913 × 3	944 × 2	811 × 5	810 × 7	101 × 8	901 × 9

Copy and divide:

2) 266	3) 273	4) 364	5) 455	6) 546
7) 567	8) 648	9) 729	7) 637	5) 405
3) 213	4) 484	2) 468	6) 606	8) 808
5) 550	6) 546	9) 909	8) 568	7) 777
7) 567	9) 549	4) 884	5) 500	8) 568
6) 546	7) 721	8) 856	9) 972	4) 836

Count to a number greater than 100:

By 2's, beginning with 1; with 2.

By 3's, beginning with 1; with 2; with 3.

By 4's, beginning with 1; with 2; with 3; with 4.

By 5's, beginning with 1; with 2; with 3; with 4; with 5.

By 6's, beginning with 1; with 2; with 3; with 4; with 5; with 6.

By 7's, beginning with 1; with 2; with 3; with 4; with 5; with 6; with 7.

By 8's, beginning with 1; with 2; with 3; with 4; with 5; with 6; with 7; with 8.

By 9's, beginning with 1; with 2; with 3; with 4; with 5; with 6; with 7; with 8; with 9.

NOTE. Practice the above drill-exercise until every pupil can go through it readily.

In counting by 2's, beginning with 2, we obtain 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, etc.

These numbers are called **even numbers**.

In counting by 2's, beginning with 1, we obtain 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, etc.

These numbers are called **odd numbers.**

With what figures do even numbers end?

With what figures do odd numbers end?

Does any even number when divided by 2 give a remainder?

Which of the following numbers are odd, and which even?

5, 7, 10, 25, 36, 38, 47, 50, 51, 55.

How many 11's in 22? in 33? in 44? in 55? in 66? in 77? in 88? in 99? in 110? in 121? in 132?

How many 12's in 24? in 36? in 48? in 60? in 72? in 84? in 96? in 108? in 120? in 132? in 144?

How many eggs are 2 dozen eggs? 3 dozen? 4 dozen? 5 dozen? 6 dozen? 7 dozen? 8 dozen? 9 dozen? 10 dozen? 11 dozen? 12 dozen?

$2\times11=?$	$7\times11=?$	$2\times12=?$	$7\times12=?$
$11\times2=?$	$11\times7=?$	$12\times2=?$	$12\times7=?$
$3\times11=?$	$8\times11=?$	$3\times12=?$	$8\times12=?$
$11\times3=?$	$11\times8=?$	$12\times3=?$	$12\times8=?$
$4\times11=?$	$9\times11=?$	$4\times12=?$	$9\times12=?$
$11\times4=?$	$11\times9=?$	$12\times4=?$	$12\times9=?$
$5\times11=?$	$10\times11=?$	$5\times12=?$	$10\times12=?$
$11\times5=?$	$11\times10=?$	$12\times5=?$	$11\times12=?$
$6\times11=?$	$11\times11=?$	$6\times12=?$	$12\times11=?$
$11\times6=?$	$11\times12=?$	$12\times6=?$	$12\times12=?$

At 12 cents each, what is the cost of 11 slates?

At 12 dollars each, what is the cost of 12 coats?

If a man works 9 hours a day, how many hours will he work in 2 weeks? in one week and a half?

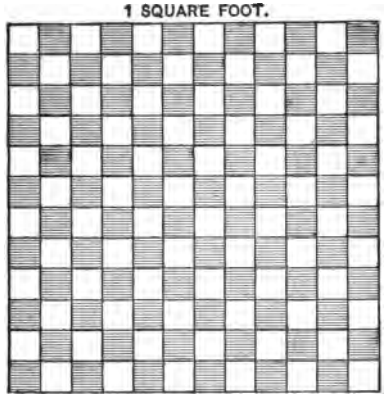
Twelve months make a year.

How many months in 2 years? in 7 years?

How many years in 36 months? in 96 months?

Thirty-six inches make a yard.

How many inches in 1 yard? in $\frac{5}{6}$ of a yard? in $\frac{3}{4}$ of a yard? in $\frac{2}{3}$ of a yard? in $\frac{1}{3}$ of a yard and $\frac{1}{4}$ of a foot? in $\frac{1}{2}$ of a yard and $\frac{1}{2}$ of a foot?



This square represents a **square foot.**

How many inches long is a side of the square?

How many square inches are there in the square?

Remember: 144 **square inches make** 1 **square foot.**

A square the side of which measures 1 yard is called a **square yard.**

If the side of a certain square is 1 yard long, how many feet long is it?

If you cut a square yard of brown paper into strips a foot wide, how many strips will you have?

How many square feet in each strip?

How many square feet in the three strips?

How many square feet, then, in a square yard?

Remember: 9 **square feet make** 1 **square yard.**

How many square inches in a square 4 inches on a side? 6 inches? 7 inches? 8 inches? 9 inches?

How many square feet in a square 2 feet on a side? 3 feet? 4 feet? 5 feet? 6 feet? 7 feet?

How many pecks in 16 quarts? in 24 quarts?

How many bushels in 8 pecks? in 12 pecks?

Add, and give the answers in bushels:

5 bu.	3 pks.	3 qts.
4	2	4
6	1	5
8	0	4

3 bu.	2 pks.	6 qts.
7	3	6
8	1	7
6	3	5

How many quarts in 4 pints? in 8 pints?

How many gallons in 8 quarts? in 12 quarts?

Add, and give the answers in gallons:

5 gals.	3 qts.	1 pt.
6	2	1
7	2	1
8	3	1

8 gals.	2 qts.	1 pt.
6	3	0
9	3	1
7	3	0

How many feet in 12 inches? in 24 inches? in 36 inches? in 48 inches? in 60 inches?

How many yards in 3 feet? in 6 feet? in 9 feet? in 12 feet? in 21 feet? in 27 feet? in 36 feet?

Add, and give the answers in yards:

6 yds.	1 ft.	9 in.
5	2	7
7	2	6
3	2	2

12 yds.	2 ft.	3 in.
15	1	4
13	2	3
19	0	2

How many square feet in 144 square inches?

How many square yards in 9 square feet? in 18 square feet? in 27 square feet? in 36 square feet?

Add, and give the answers in square yards:

7 sq. yds.	3 sq. ft.	86 sq. in.
5	5	58

11 sq. yds.	6 sq. ft.	121 sq. in.
13	2	23

Name the lowest coin in United States money.

How many cents make a dollar?

One hundred cents make a dollar.

How many cents make a half of a dollar?

How many cents make a quarter of a dollar?

A ten-cent piece is sometimes called a **dime.**

How many cents make a dime? a half-dime?

Of what metal are dollars, halves, quarters, and dimes made?

The sign $ is called the **dollar sign,** and is placed before the figures.

One dollar is written $1, or $1.00.

Eleven dollars and twenty-five cents is written $11.25.

The dot after the $11 in $11.25 means that the two figures on the right of it stand for cents, and the figures on the left of it stand for dollars.

The dot between the figures for dollars and the figures for cents is called the decimal point.

Read: $5.03; $7.27; $42.56; $12.23; $13.67; $67.53; $18.91; $98.01; $107.31; $121.02.

How many places do the cents occupy?

Remember: **The cents always occupy two places.**

Write in figures:

Three dollars and five cents.

Forty-five dollars and seventy-three cents.

Thirty-five dollars and sixty-seven cents.

Nineteen dollars and eighteen cents.

Eighty-nine dollars and ten cents.

One hundred five dollars and two cents.

One hundred seventeen dollars and one cent.

One hundred three dollars and three cents.

One hundred nine dollars and five cents.

One hundred one dollars and one cent.

Two hundred seventy dollars and nine cents.

Two hundred dollars and eight cents.

Three hundred dollars and twenty-five cents.

Two hundred dollars and fifty cents.

Add:

\$2.03	\$8.12	\$12.12	\$14.05	\$30.03
3.04	7.32	13.13	11.10	20.02
3.21	5.13	21.21	31.32	40.01
5.51	6.41	32.32	23.50	50.50
\$5.43	\$9.34	\$8.27	\$11.17	\$13.37
1.27	2.18	9.36	25.25	72.26
3.19	6.25	10.19	37.37	87.19

Subtract:

\$7.45	\$7.89	\$8.59	\$9.33	\$36.55
− 5.03	− 4.63	− 5.26	− 7.29	− 28.00
\$9.51	\$5.65	\$6.41	\$6.73	\$17.44
− 3.28	− 1.27	− 2.38	− 1.09	− 8.36

Multiply:

\$1.13	\$2.24	\$5.10	\$8.12	\$9.08
3	4	5	6	7
\$11.07	\$12.09	\$9.07	\$7.09	\$6.08
8	9	9	7	8

Divide:

\$16.08 by 2.	\$12.24 by 6.	\$56.56 by 8.
\$12.24 by 2.	\$24.12 by 6.	\$64.08 by 8.
\$18.36 by 3.	\$35.35 by 7.	\$54.54 by 9.
\$24.12 by 4.	\$49.42 by 7.	\$81.09 by 9.
\$25.05 by 5.	\$56.56 by 7.	\$63.72 by 9.

Ten mills make 1 cent.

What part of a cent is one mill? 2 mills? 3 mills? 5 mills? 7 mills? 10 mills?

Since 1 mill is 1 **tenth** of a cent, how many cents are twenty mills? 30 mills? 50 mills?

We write mills on the right of cents.

Two dollars 87 cents and 5 mills are written $2.875.

Thirty-seven cents and 5 mills are written $0.375.

Read: $3.607; $5.546; $18.364; $0.253.

Write in figures:

Seven dollars sixty cents and eight mills.

Eleven dollars seventy-five cents and five mills.

Twenty-one dollars two cents and two mills.

Ninety-nine cents and seven mills.

A ten-cent piece is often called a **dime.**

Ten dimes make a dollar.

What part of a dollar is 1 dime? 2 dimes? 3 dimes? 4 dimes? 5 dimes? 6 dimes? 10 dimes?

How many **tenths** of a dollar make the dollar?

How many **tenths** of a cent make the cent?

How many **tenths** of *any unit whatever* make **the whole unit?**

Tenths occupy one place, the first place to the right of the decimal point.

The number seven and three-tenths is written 7.3.

The number 6.5 is read six and five *tenths.*

The number 0.7 is read seven *tenths.*

Since 100 cents make a dollar, 1 cent is 1 **hundredth** of a dollar.

How many hundredths of a dollar are 2 cents? 3 cents? 5 cents? 10 cents? 25 cents? 50 cents?

How many **tenths** of a dollar are 10 cents?

How may **hundredths** of a dollar are 10 cents?

How many hundredths, then, make 1 tenth?

Remember: 10 **hundredths make 1 tenth.**

10 **tenths make 1 unit.**

The number, three and five hundredths, is written, 3.05. The number, two and sixty-four hundredths, is written, 2.64.

Remember:

Hundredths always occupy two places.

Read: 5.08; 7.21; 10.54; 17.27; 65.65; 7.6; 6.07; 8.9; 8.09; 7.8; 7.08; 90.9; 90.09; 81.81.

Write in figures:

Five and five tenths.

Seventy-five and eighty-six hundredths.

Nine hundred one and nine hundredths.

Seventy-six and twenty-five hundredths.

Fifty-five and fifty hundredths.

How many hundredths are:

8 hundredths + 9 hundredths?

14 hundredths − 5 hundredths?

16 hundredths − 7 hundredths?

3×4 hundredths?

7×8 hundredths?

6×9 hundredths?

$\frac{1}{9}$ of 63 hundredths?

$\frac{1}{7}$ of 56 hundredths?

$\frac{1}{4}$ of 36 hundredths?

The number denoted by figures at the right of the decimal point is called a **decimal number,** or simply a **decimal.**

In adding or subtracting numbers containing decimals *put the decimal point in the result directly under the column of decimal points in the given numbers.*

Add:

51.8	26.7	36.3	63.8
36.2	37.5	57.3	38.6
47.6	62.5	25.6	32.7
15.5	54.7	47.5	87.9
8.15	7.62	6.33	3.68
2.63	7.35	3.57	6.38
7.46	2.65	5.26	2.37
5.51	4.57	7.45	7.89
8.51	7.62	6.33	8.63
−2.36	−3.57	−3.75	−6.83
92.3	64.7	62.5	75.4
−35.7	−26.5	−45.7	−55.5
9.32	6.74	2.56	7.37
−7.25	−2.65	−1.19	−2.89
3.77	81.2	47.6	56.2
−1.98	−36.9	−28.7	−19.5

A farmer paid $160 for a horse and ¼ as much for a cow. How much did he pay for the cow?

A lady bought some blankets for $15 and some silk for $25. She gave ten-dollar bills in payment. How many bills did she give?

A boy bought a pair of boots for $4.25. He gave a five-dollar bill in payment. How much change did he receive?

A man earned in a week $19.50, and spent $12.25. How much did he save?

James earned $6.25, and his brother gave him enough to make $10. How much did his brother give him?

What will 9 barrels of flour cost at $6.10 a barrel?

What will 8 sheep cost at $6.10 apiece?

What will 5 hats cost at $3.10 apiece?

A lady bought a shawl for $11.50, and a hat for $8. She gave a twenty-dollar bill in payment. How much change did she receive?

Henry bought 3 pounds of beefsteak at 23 cents a pound, and gave a dollar-bill in payment. How much change did he receive?

At $0.50 a pound, how many pounds of Jersey butter can be bought for $2.50?

How many pounds of coffee at $0.30 a pound can be bought for $0.90?

At 8 cents a pound, how many pounds of rice can be bought for $0.56?

THE YEAR.

How many months make one year?

Twelve months make a year.

The names of the months in order are:

January, February, March, April, May, June, July, August, September, October, November, December.

The spring months are March, April, May.

The summer months are June, July, August.

The autumn months are September, October, November.

The winter months are December, January, February.

Spring, summer, autumn, winter, are called the **four seasons** of the year.

Thirty days have September, April, June, and November.

February has 28 days, and in leap years 29 days.

The other months have 31 days each.

Three hundred sixty-five days make a year.

Three hundred sixty-six days make a leap year.

When the date of the year can be divided by 4 without remainder, or in case the date ends in two zeros by 400, the year is a leap year.

Which of these years are leap years? 1800; 1860; 1872; 1890; 1893; 1892; 1900; 2000.

In a common year, how many days from the beginning of the year to February 15? to March 31? to April 7? to May 1? to June 14? to July 20?

THOUSANDS.

The number, 10 hundred, is called a thousand.

A thousand is written 1,000.

A thousand and one is written 1,001.

Ten thousand and ten is written 10,010.

One hundred twenty thousand four hundred is written 120,400.

How many thousands and simple units in 7,632 ? 50,023 ? 41,701 ? 417,203 ? 500,230 ?

Write in figures and read all the numbers from 4,002 to 4,020; from 80,997 to 81,010; from 537,091 to 537,102; from 748,987 to 749,000.

Read: 5,430; 3,072; 1,010 ; 45,320; 70,045; 40,309; 36,008 ; 113,079; 273,002; 182,012; 811,200; 100,256; 500,005; 300,023; 608,300.

Write in figures:

Four thousand. Three thousand seven.

Six thousand ten. Five thousand fifteen.

Eight thousand three.

Nine thousand seven hundred.

Six thousand twenty-eight.

Seventy-four thousand six hundred.

Fifteen thousand five hundred.

Sixty-nine thousand thirty-two.

Seventy-three thousand five hundred forty-six.

Eight hundred thousand seven hundred five.

Ninety-six thousand eight hundred fifty-six.

Two hundred fifty thousand two hundred fifty.

Two hundred five thousand two hundred five.

MILLIONS.

When we write numbers which contain thousands and simple units, we leave a little space after the last figure of the thousands, and put a comma in this space. Thus, 236 347 is written 236,347.

This comma divides the figures into two **periods,** the period of thousands and the period of units.

Forty-eight thousand and thirty-six sheep is written, 48,036 sheep. Here we write 48 for the word *forty-eight;* then put a comma after the 8 for the word *thousand;* then 0, as there are no hundreds, and lastly, 36 for the word *thirty-six.*

The unit for the units' period is 1 sheep.

The unit for the thousands' period is 1000 sheep.

The unit for the next higher period is a **million.**

A million is 1000 thousands, and is written

1,000,000.

The unit of any period is equal to 1000 units of the next lower period.

Three hundred million two hundred forty-six thousand five hundred dollars is written

$300,246,500

Here we put a comma after the 300 for the word *million,* and after the 246 for the word *thousand.*

The left-hand period may have one, two, or three figures, but **every other period must have three figures,** one figure for the hundreds, one for the tens, and one for the units, of that period.

BILLIONS.

The unit of the *fourth* period is a **billion.**

A billion is 1000 millions, and is written

1,000,000,000.

The unit of the *fifth* period is a **trillion.**

	Billions	Millions	Thousands	Units
Read:	16,	016,	217,	320.

Read:

32,027,020.	316,106,270,032.
100,370,200.	70,000,035,300.
275,107,005.	170,202,305,003.
57,071,050.	28,028,280,028.

Write in figures:

Sixty-one billions six millions sixty thousands six hundreds.

How many *periods* in this number?

How many figures are required to express the billions? the millions? the thousands?

The method of writing numbers by figures is called **Notation**; and the method of reading numbers written by figures is called **Numeration.**

Rule for Numeration. *Begin at the right and mark off the numbers into periods of three figures each by commas. Begin at the left and read each period as if it stood alone, adding its name.*

Rule for Notation. *Begin at the left and write the hundreds, tens, and units of each period in order, putting zeros in vacant places, and a comma after each period.*

DECIMAL FRACTIONS.

If a unit is divided into **ten equal parts,** each part is called a **tenth**; if into a **hundred equal parts,** each part is called a **hundredth**; if into a **thousand equal parts,** each part is called a **thousandth.** Such parts are called **decimal fractions**; or, **decimals.**

In distinction, numbers used to count **whole units** are called **whole numbers,** or **integral numbers.**

Tenths occupy **one** decimal place 0.1
Hundredths occupy **two** decimal places 0.21
Thousandths occupy **three** decimal places . . . 0.213
Ten-thousandths occupy **four** decimal places . . 0.2134

The decimal 0.1 is read one *tenth;* 0.21 twenty-one *hundredths;* 0.213 two hundred thirteen *thousandths;* 0.2134 twenty-one hundred thirty-four *ten-thousandths;* 4.4045 is read four *and* four thousand forty-five *ten-thousandths.*

NOTE. In reading a number, part of which is integral and part decimal, pronounce *and* at the decimal point and omit it in all other places.

Read: 1.09; 23.023; 50.107; 7.0017; 7.0209; 5.5055; 2.3785; 15.0015; 6.2567.

Write in figures: two and five tenths; two and five hundredths; two and five thousandths; two and five ten-thousandths; two and twenty-five hundredths; two and twenty-five thousandths; two and twenty-five ten-thousandths; two and two hundred twenty-five thousandths; two and two hundred twenty-five ten-thousandths; two and six thousand three hundred seventy-six ten-thousandths.

ADDITION.

To *add* two or more numbers is to form a new number equal to the given numbers counted together. This new number is called the **sum** of the given numbers.

Numbers can be added only when they denote units of the *same kind*. We cannot add 5 pears and 7 plums.

The sign of addition is +, and is read *and*, or *plus*. Thus, 4 + 5 is usually read, four *plus* five.

The sum of two or more numbers is the same in whatever order they are added. 4 + 5 = 9, and 5 + 4 = 9.

To *prove* addition, that is, to *test* the correctness of the work, add in a different order; the result should be the same. Thus, if we have added from the bottom to the top, we add from the top to the bottom.

ORAL EXERCISES.

Name the sums:

1.	11	22	33	44	55	66	77	88	99
	+5	+5	+5	+5	+5	+5	+5	+5	+5
2.	11	22	33	44	55	66	77	88	99
	+6	+6	+6	+6	+6	+6	+6	+6	+6
3.	11	22	33	44	55	66	77	88	99
	+7	+7	+7	+7	+7	+7	+7	+7	+7
4.	11	22	33	44	55	66	77	88	99
	+8	+8	+8	+8	+8	+8	+8	+8	+8

SLATE EXERCISES.

Begin at the right to add, and write under each column the *ones* of the sum; and add the *tens* of the sum, if any, with the next column. Write the entire sum of the last column.

1.	2.	3.	4.	5.	6.	7.
321	615	522	178	312	124	673
502	143	617	512	723	780	485
279	687	843	296	677	379	289

8.	9.	10.	11.	12.	13.
4321	3214	5423	8372	70.52	58.23
2751	5467	6543	543	53.84	1.92
6284	873	7654	7941	98.72	64.95
863	9124	6785	9078	8.76	8.67

Arrange and add, taking care to *have units of the same order stand in the same column.*

Decimals are easily arranged by taking care to have the decimal points stand in a vertical column.

14. 43,307; 96,812; 60,798; 21,121.
15. 83,654; 34,747; 58,659; 32,321.
16. 59.852; 41.664; 68.054; 90.594.
17. 10.5921; 27.3007; 31.9789; 2.563.
18. $5.86; $561.75; $28.32; $40.50.
19. 121,016; 167,404; 84,121; 66,456.
20. 90.0542; 32.8971; 55.674; 348.78.
21. 64.3372; 6.4337; 0.3723; 100.733.
22. 0.415; 70.634; 121.5007; 8.3467.
23. 8.0213; 15.101; 12.0031; 0.2256.
24. 121.0015; 100.37; 148.561; 1121.505.
25. $5.86; $8.78; $11.89; $12.58; $95.37; $59.88.

SLATE EXERCISES.

1. John Dix deposited in the Third National Bank of Boston $4321, and a week later $13,893. How much did he deposit in all?

2. The steamer Majestic made on four successive days 503, 504, 505 and 505 miles. How many miles did she make in the four days together?

3. In 1890 the population of New York was 1,513,501, of Brooklyn 804,377, and of Jersey City 162,317. What was the population of these three cities?

4. In 1890 St. Louis had 460,357 inhabitants, Boston had 447,720, Baltimore 432,095, and San Francisco 297,990. How many had these four cities together?

5. In 1890 Chicago had 1,098,576 inhabitants, Milwaukee 206,308, Minneapolis 164,738, St. Paul 133,156. How many had these four cities together?

6. In 1890 Philadelphia had 1,044,894 inhabitants, Pittsburgh 238,473, Alleghany 104,967, Scranton 83,450. What is the population of the four largest cities of Pennsylvania?

7. In 1890 Cincinnati had 296,309, Cleveland 261,546, Buffalo 255,543, Detroit 205,669. How many had these four cities together?

8. In 1890 Washington had 228,160, New Orleans 241,995, Louisville 161,005, and Richmond 80,838. Find the population of these four cities together.

SUBTRACTION.

The operation of taking a smaller number from a larger one is called **Subtraction.** The result is called the **remainder** or **difference.**

The larger number is called the **minuend.**

The smaller number is called the **subtrahend.**

In subtraction the numbers must denote *units of the same kind.* We cannot subtract 5 apples from 7 pears.

The sign of subtraction is a dash − called the **minus** sign, and when placed between two numbers means that the second number is to be subtracted from the first. Thus, $9-4$ is usually read, nine *minus* four. $5-5=0$ is read, five minus five is equal to zero.

To *prove* subtraction, add the subtrahend and the remainder; and this sum will be equal to the minuend if the work is correct.

ORAL EXERCISES.

Name the differences:

1.	10	21	30	41	52	60	71	82	93
	−2	−2	−3	−3	−3	−4	−4	−4	−4
2.	10	21	32	43	54	60	71	82	93
	−5	−5	−5	−5	−5	−6	−6	−6	−6
3.	14	25	30	41	52	63	74	85	96
	−6	−6	−7	−7	−7	−7	−7	−7	−7
4.	10	21	32	43	54	65	76	87	10
	−8	−8	−8	−8	−8	−8	−8	−8	−9

SLATE EXERCISES.

If the number of units of any order in the subtrahend is greater than the number above it, add 10 to the number above it, and then subtract.

Afterwards subtract the next number of the subtrahend from the number above it decreased by 1. Thus:

736
427
309

Beginning on the right, subtract 7 from 16, and write 9 below.

Afterwards subtract 2, not from 3, but from 2, and write 0 below. Then subtract 4 from 7, and write 3 below.

9000
7658
1342

Subtract 8 from 10, and write 2; then subtract 5, not from 10, but from 9, and write 4; again, subtract 6 from 9, and write 3; then subtract 7 from 8, and write 1.

Proof. Add 427, 309, 736.

Proof. Add 7658, 1342, 9000.

Subtract:

1. 873 − 169	6. 3850 − 1929	11. 60570 − 48692	16. 462085 − 345396
2. 679 − 298	7. 5435 − 1567	12. 20729 − 17934	17. 701406 − 243859
3. 700 − 177	8. 5634 − 5284	13. 32405 − 21657	18. 740052 − 698253
4. 901 − 475	9. 9005 − 6476	14. 20604 − 11847	19. 402701 − 317485
5. 506 − 347	10. 3401 − 2085	15. 60004 − 28597	20. 400100 − 375916

SUBTRACTION OF DECIMALS.

In the subtraction of decimals, make the number of decimal places in the minuend and subtrahend the same, annexing zeros if necessary.

Subtract 25.468 from 52.1253; and 2.1789 from 7.2.

OPERATION.	OPERATION.
52.1253	7.2000
25.4680	2.1789
26.6573	5.0211

Arrange so that the decimal point of the subtrahend shall be under that of the minuend, and subtract:

1. 0.85 − 0.79.
2. 1.76 − 0.98.
3. 2.729 − 1.836.
4. 5.482 − 3.176.
5. 2.354 − 2.287.
6. 3.826 − 3.719.
7. 5.902 − 3.678.
8. 5.77 − 4.888.
9. 9.62 − 3.765.
10. 8.42 − 5.661.
11. 7.23 − 6.562.
12. 9.02 − 7.163.
13. 4.31 − 3.425.
14. 1.27 − 1.198.
15. 1.46 − 0.955.
16. 13.2589 − 10.06.
17. 71.1002 − 52.387.
18. 11.2487 − 5.3579.
19. 10.9041 − 9.8765.
20. 17.3258 − 16.37.
21. 2.5 − 0.025.
22. 75 − 0.7575.
23. 1.52 − 1.0024.
24. 129.5 − 96.349.
25. 0.157 − 0.1547.
26. 752.8 − 4.9732.
27. 819.3 − 57.687.
28. 83.52 − 64.743.
29. 61.98 − 4.3554.
30. 6.716 − 0.8725.

SLATE EXERCISES.

1. Shakespeare was born in 1564 and died in 1616. How many years did he live?

2. Milton was born in 1608 and died in 1674. How many years did he live?

3. Daniel Webster died in 1852 at the age of 70. In what year was he born?

4. President Washington's first inaugural address contained 1300 words. His second inaugural address contained 134 words. How many more words did the first contain than the second?

5. President Lincoln's first inaugural address contained 3500 words. His second inaugural address contained 580 words. How many more words did the first contain than the second?

6. The population of Kansas City was 55,585 in 1880, and 132,416 in 1890. Find the increase.

7. The population of Denver was 35,629 in 1880, and 106,670 in 1890. Find the increase.

8. The population of Omaha was 30,518 in 1880, and 139,526 in 1890. Find the increase.

9. The number of silk looms in the United States in 1880 was 8474, and in 1890 the number was 22,569. Find the increase.

10. There are CL Psalms. James has read XCIX. How many more has he to read?

11. A woman bought groceries to the amount of $3.83. She gave a five-dollar bill in payment. How much change should she receive?

MULTIPLICATION.

The operation of taking one number as many times as there are units in another is called **Multiplication.**

The number which we multiply is called the **multiplicand.** The number by which we multiply is called the **multiplier.** The result of the multiplication is called the **product.**

The sign of multiplication is ×, and is read *times* if the multiplier *precedes* the multiplicand; but is read *multiplied by* if the multiplier *follows* the multiplicand. Thus, 4 × $6 is read 4 *times* six dollars, but $6 × 4 is read 6 dollars *multiplied by* 4.

The multiplicand and multiplier are called *factors* of the product. If either factor is 0, the product is 0. The product of two factors is not changed if the *order* of the factors is changed.

To *prove* multiplication, change the order of the factors, and multiply again. If the product is the same in both cases, it may be assumed to be correct.

SLATE EXERCISES.

1. 143 ×2	**4.** 211 ×5	**7.** 4312 ×2	**10.** 6010 ×6
2. 312 ×3	**5.** 311 ×6	**8.** 1212 ×4	**11.** 2330 ×2
3. 122 ×4	**6.** 223 ×3	**9.** 2111 ×5	**12.** 2011 ×7

If a product greater than 9 is obtained in multiplying, the figure for the *ones* only is written, and the *tens* are added to the following product.

Thus, in the problem in the margin $4 \times 8 = 32$, we write the 2; then $4 \times 5 = 20$, and to the 20 we add the 3 tens of the last product, obtaining 23; we write the 3; then $4 \times 3 = 12$, and to the 12 we add the 2 tens of the last product, obtaining 14, which we write. The entire product is therefore 1432.

$$\begin{array}{r} 358 \\ 4 \\ \hline 1432 \end{array}$$

SLATE EXERCISES.

1. 2×3687.	18. 5×8267.	35. 4×29354.
2. 2×4783.	19. 6×6754.	36. 5×70528.
3. 3×2879.	20. 7×7854.	37. 6×56713.
4. 3×3657.	21. 7×9384.	38. 7×31567.
5. 5×1953.	22. 8×4337.	39. 8×37582.
6. 5×2849.	23. 3×9785.	40. 9×56014.
7. 4×3567.	24. 3×8694.	41. 9×34749.
8. 4×2586.	25. 7×2334.	42. 9×36927.
9. 5×6852.	26. 9×1682.	43. 9×73186.
10. 6×1376.	27. 5×9889.	44. 8×25839.
11. 6×5647.	28. 4×8977.	45. 7×98325.
12. 6×3124.	29. 6×9778.	46. 8×63578.
13. 3×8798.	30. 7×3879.	47. 9×67489.
14. 7×2342.	31. 9×3355.	48. 7×38697.
15. 8×4323.	32. 8×6675.	49. 9×48769.
16. 9×5215.	33. 7×8643.	50. 7×57009.
17. 4×7826.	34. 9×6854.	51. 8×99798.

If the multiplier has two or more figures:

Multiply by each figure separately, taking care to put the first figure of each product directly under the figure of the multiplier used in obtaining it; and add the products. Thus,

8547	7235
236	2046
51282	43410
25641	28940
17094	14470
2017092	14802810

Proof. 236	*Proof.* 2046
8547	7235
1652	10230
944	6138
1180	4092
1888	14322
2017092	14802810

Multiply:

1. 114 by 32.	11. 714 by 48.	21. 3159 by 507.
2. 112 by 76.	12. 578 by 97.	22. 3819 by 206.
3. 365 by 56.	13. 842 by 86.	23. 8769 by 517.
4. 372 by 23.	14. 682 by 69.	24. 5731 by 475.
5. 283 by 64.	15. 792 by 79.	25. 8592 by 486.
6. 564 by 47.	16. 8763 by 407.	26. 7069 by 908.
7. 259 by 57.	17. 8437 by 502.	27. 5604 by 609.
8. 538 by 38.	18. 9872 by 603.	28. 6789 by 789.
9. 467 by 59.	19. 7356 by 805.	29. 4769 by 687.
10. 736 by 94.	20. 5983 by 704.	30. 6897 by 976.

If the multiplier is 10, 100, 1000, etc., we obtain the product by annexing to the multiplicand as many zeros as there are in the multiplier.

Thus, 100 times 746 is 74,600.

In short, if one or both factors end in zeros, multiply without regard to the zeros.

Afterwards annex to the product as many zeros as there are at the ends of the factors together. Thus,

To multiply 742,000 by 2300, first multiply 742 by 23, and obtain 17,066. To this number annex 5 zeros, and get 1,706,600,000 for the true result.

Multiply :

1. 467 by 10.
2. 312 by 100.
3. 587 by 1000.
4. 6112 by 3000.
5. 7281 by 4000.
6. 8127 by 5000.
7. 43070 by 2000.
8. 43200 by 2340.
9. 56000 by 3480.
10. 50060 by 7000.
11. 50400 by 2080.
12. 47000 by 2070.
13. 504304 by 100.
14. 7120 by 7002.
15. 102039 by 112000.
16. 932600 by 184900.

17. If a man takes 180 steps a minute, how many steps will he take in an hour ?

18. If a man takes 2400 steps a mile, how many steps will he take in walking 20 miles ?

19. A cat has 18 toes. How many toes will 6000 cats have ?

20. At 60 cents a yard, what will be the cost of digging a drain 350 yards long ?

If one or both factors have decimal places:

Multiply without regard to the decimal point.

Afterwards point off in the product as many decimal places as there are decimal places in the two factors together. Thus:

Multiply 20.15 by 0.05.

$$\begin{array}{r} 20.15 \\ 0.05 \\ \hline 1.0075 \end{array}$$

We multiply 20.15 by 0.05 and obtain 10075. As there are 2 decimal places in the multiplicand and 2 in the multiplier, we point off 4 decimal places in the product and have 1.0075, one and seventy-five *ten-thousandths.*

SLATE EXERCISES.

Multiply:

1. 0.541 by 444.
2. 0.853 by 232.
3. 3764 by 0.47.
4. 32.12 by 1.73.
5. 7860 by 46.8.
6. 0.623 by 373.
7. 763.2 by 8.65.
8. 68.42 by 75.5.
9. 8730 by 0.05.
10. 2.406 by 0.35.
11. 0.048 by 723.
12. 0.008 by 2.05.
13. 22.74 by 0.525.
14. 3792 by 0.024.
15. 0.715 by 141.5.
16. 466.4 by 45.06.
17. 3.417 by 1000.
18. 0.955 by 10000.
19. 6781 by 1.007.
20. 527.1 by 0.103.
21. 56.95 by 0.45.
22. 426.8 by 0.204.
23. 84.49 by 54.49.
24. 700.7 by 7.071.

SLATE EXERCISES.

1. A clock that strikes the hours, and 1 for the first quarter, 2 for the second and 3 for the third quarter, of each hour, strikes 300 times a day. How many times will it strike in a common year?

2. A clock that strikes the hours only, strikes 156 times in a day. How many times will it strike in a leap year?

3. If corn is $1.12 a bag, how much will 60 bags cost?

4. If coal is $5.75 a ton, how much will 17 tons cost?

5. If pine wood is $3.50 a cord, how much will 19 cords cost?

6. A farmer has 37 acres of corn worth on the average $27 an acre. What is the total value of his corn crop?

7. The earth moves in its orbit 19 miles a second. How many miles does it move in 1 minute?

8. If a bricklayer earns on the average $20.25 a week, how much will he earn in 28 weeks?

9. The lunar month is 29.53 days. How many days are there in 12 lunar months?

10. Sound travels at the rate of 1120 feet a second. Find the distance of a thunder-cloud when the thunder is heard 13 seconds after the lightning is seen.

11. A dealer sold 27 bushels of potatoes at 30 cents a peck. How much did he receive?

BILLS.

A **Bill of Goods** is a written statement of goods sold, and of payments, if any, received for them.

A **Bill of Services** is a written statement of services rendered, or of labor performed.

A **Statement of Account** is a statement of the sum due according to the accounts already rendered. Thus,

Mr. Jones, To BROWN & CO., Dr.

June 1	*To Account rendered*	*$60*

The **Creditor** is the person who sells the goods, or who performs the labor.

The **Debtor** is the person who buys the goods, or who pays for the services rendered.

The **Debit Side of the Account** consists of the items due to the person who renders the account.

The **Credit Side** consists of the amounts received by the person who renders the account.

The **Balance of an Account** is the difference between the amounts of the Debit and Credit Sides.

NOTE. When a bill is paid, it should be receipted by writing at the bottom of the bill the date of payment and the words *Received payment*, and under these words the creditor should sign his name and deliver the receipt to the debtor.

If a clerk has authority to sign his employer's name, he should write under his employer's name his own name preceded by the word **by** or **per.**

RECEIPTED BILLS OF GOODS.

Boston, June 1, 1893.

Mr. Robert Thomson,

Bought of CHARLES EDMONDS.

1893					
May	*15*	*10 lbs. Coffee*	*@ 35 ¢*	*$3*	*50*
		50 lbs. Sugar	*@ 5 ¢*	*2*	*50*
		2 lbs. Tea	*@ 65 ¢*	*1*	*30*
		28 lbs. Butter	*@ 32 ¢*	*8*	*96*
				16	*26*

June 2, 1893. *Received payment,*

Charles Edmonds.

Exeter, June 1, 1893.

James York,

To KELLY & GARDNER, Dr.

1893							
Mar.	*8*	*To 2 gals. Molasses*	*@*	*55¢*	*$1*	*10*	*$*
		To 2 bbls. of Flour	*@*	*$5.75*	*11*	*50*	*12* *60*
Apr.	*5*	*To 15 lbs. Rice*	*@*	*9¢*	*1*	*35*	
		To 25 lbs. Butter	*@*	*33¢*	*8*	*25*	*9* *60*
							22 *20*
		Cr.					
Mar.	*8*	*By 2 cords Birches*	*@*	*$4.50¢*	*9*	*00*	
		By 3 bu. Potatoes	*@*	*65¢*	*1*	*95*	*10* *95*
		Balance due					*11* *25*

June 1, 1893. *Received payment,*

Kelly & Gardner,
By James Staples.

Wants them.

Make out bills, and receipt for them the first day of the month that follows the purchase:

1. *Mr. Leonard Smith,*

Bought of JOHN THOMPSON & CO.

1893						
Feb.	*7*	*9 lbs. Ham*	*@ 15¢*			
		18 " Steak	*@ 25¢*			
"	*13*	*15 " Mutton*	*@ 16¢*			
		11 " Veal	*@ 11¢*			

2. *James Coffin,* To HOWARD MANSUR, Dr.

1893						
May	*3*	*25 lbs. Codfish*	*@ 9¢*			
"	*10*	*30 " Bacon*	*@ 14¢*			
"	*18*	*10 " Coffee*	*@ 35¢*			
"	*25*	*2 bbls. Flour*	*@ $5.75*			

3. *John Marshall,* To ROBERT STUART, Dr.

1893						
Mar.	*8*	*12 doz. Eggs*	*@ 26¢*			
		17 lbs. Butter	*@ 32¢*			
"	*15*	*34 " Cheese*	*@ 8¢*			
		16 bu. Potatoes	*@ 85¢*			

4.

1893						
Apr.	*5*	*27 bags Whole Corn*	*@ $1.12*			
		30 " Meal	*@ 1.00*			
"	*12*	*60 " Oats*	*@ 0.65*			
		7 tons Hay	*@ 17.00*			
"	*19*	*Cr.*				
		By Cash	*$200*			

TENTH NATIONAL BANK.

IN ACCOUNT WITH *John Gresham.*

DATE.		DEPOSITS.			CHECKS.	
1893						
May	*1*	*Bal.*	*214*	*75*	*105*	*25*
"	*8*	*Dep.*	*116*	*37*	*217*	*30*
"	*15*	"	*130*	*00*	*37*	*00*
"	*22*	"	*275*	*50*	*50*	*00*
"	*23*	"	*150*	*00*	*Bal.*	
June	*1*	*Bal.*				
"	*5*	*Dep.*	*450*	*00*	*200*	*57*
"	*6*	"	*150*	*00*	*187*	*13*
"	*7*	"	*180*	*00*	*113*	*45*
"	*17*	"	*280*	*50*	*Bal.*	
July	*1*	*Bal.*			*50*	*35*
"	*8*	*Dep.*	*165*	*00*	*60*	*55*
"	*15*	"	*245*	*50*	*32*	*58*
"	*22*	"	*300*	*70*	*200*	*00*
"	*23*	"	*150*	*30*	*120*	*30*
"	*29*	"	*170*	*50*	*117*	*50*
					Bal.	

NOTE. By the above bank account Mr. Gresham had a balance to his credit of $214.75, on May 1, 1893. Find the balance at the end of May, by finding the difference between the sum of the items under "deposits" and the sum of the "checks"; and write this balance opposite the word *Bal.* on the right of the page. Enter this balance also opposite June 1, as the amount Mr. Gresham had in bank June 1. The cashier returns the checks with the date of payment stamped on each to the depositor, when he balances the book.

Make out bills for the following transactions:

1. Messrs. Lord & Everett bought of Noyes, Child & Smith, April 15, 1893, 16 yds. of Brussels carpet @ $1.65; made and laid at @ 12 cts. a yard; 12 yds. lining @ 10 cts.; 2 hassocks @ $1.00.

2. Messrs. Gordon & Hill bought of Vinal, Gould & Co., April 1, 1893, 10 cords of oak wood @ $5.50; 6 cords of pine wood @ $3.50, and 7 cords of hickory @ $6.50.

3. Messrs. Green & Co. bought of Smith & Harris, May 1, 1893, 7 lbs. of steak @ 23 cts.; 6 lbs. of lamb @ 14 cts.; 10 lbs. of roast beef @ 18 cts.; 9 lbs. of veal @ 8 cts.

4. Mr. Edward Scott bought of James Donovan, April 1, 1893, 2 doz. door locks @ $4.50; 5 doz. padlocks @ $2.50; 3 doz. steel shovels @ $10.50; 7 doz. spades @ at $9.50.

5. Lord & Sampson sold to Mr. J. H. Simpson, May 5, 1893, 5 reams of letter paper @ $4.25; 3 reams of foolscap @ $3.25; 6 boxes of envelopes @ $1.25; 3 quires blotting paper @ 17 cts.

6. John Tompkins sold to Mrs. Jameson, May 3, 1893, 14 yds. print @ 7 cts.; 37 yds. cotton cloth @ 9 cts.; 15 yds. silk @ $2.25; 7 yds. plush @ $1.75; 6 doz. buttons @ 35 cts.

7. John Seamons sold to Mr. Samuel Mitchell, May 2, 1893, 24 window-sash @ $3.50; 4 outside doors @ $4.50; 18 inside doors @ $1.75; 24 pairs blinds @ 60 cts.; 8 ventilator slides @ 40 cts.

Part IV.

LESSON 1.

DIVISION.

To divide $42 by 6 is to find *the number of dollars* in each part when $42 is divided into 6 *equal parts;* that is, to find the *number of dollars* which must be taken 6 times to make $42. Again, to divide $42 by $6 is to find *the number of times* that it is necessary to take $6 to make $42. In either case, the *product* and *one factor* are given and *the other factor* is required. Hence,

Division is an operation by which when *the product* and *one factor* are given *the other factor* is found.

The number to be divided is called the **dividend,** the number by which the dividend is to be divided is called the **divisor,** and the result is called the **quotient.**

Division is indicated by *the sign of division* $\div$, or by writing the dividend over the divisor with a line between them. Thus, each of the expressions $42 \div 6$ and $\frac{42}{6}$ means and is read, forty-two *divided by* six.

The complete quotient of $45 \div 8$ is $5\frac{5}{8}$.

Divide and give the complete quotient:

1. 24 by 3.	**5.** 20 by 3.	**9.** 18 by 4.	**13.** 42 by 5.
2. 27 by 3.	**6.** 24 by 4.	**10.** 15 by 4.	**14.** 38 by 5.
3. 26 by 3.	**7.** 28 by 4.	**11.** 25 by 5.	**15.** 17 by 5.
4. 23 by 3.	**8.** 26 by 4.	**12.** 45 by 5.	**16.** 24 by 6.

LESSON 2.

Divide 654 by 3.

$$3\overline{)654}\quad 218$$

Here $6 \div 3 = 2$, and as 6 is in the place of hundreds, we write 2 in the place of hundreds under the 6.

Then $5 \div 3 = 1$, with remainder 2.

We write the 1 in the place of tens, under the 5.

The remainder 2 is 2 tens or 20 ones, and 20 ones put with the 4 ones make 24 ones.

Then $24 \div 3 = 8$, and we write 8 in the place of ones, under the 4.

The quotient, therefore, is 2 hundreds, 1 ten, and 8 ones; that is, 218.

Divide 564 by 3.

$$3\overline{)564}\quad 188$$

Here $5 \div 3 = 1$, with remainder 2. We write the 1 in the place of hundreds, under the 5.

The remainder 2 is 2 hundreds, or 20 tens, and 20 tens put with 6 tens make 26 tens.

Then $26 \div 3 = 8$, with remainder 2.

We write the 8 in the place of tens, under the 6.

The remainder 2 is 2 tens, or 20 ones, and 20 ones put with 4 ones make 24 ones.

Then $24 \div 3 = 8$, and we write 8 in the place of ones, under the 4.

The quotient, therefore, is 1 hundred, 8 tens, and 8 ones; that is, 188.

Divide 765 by 9.

$$9\overline{)765}\quad 85$$

Since 7 will not contain 9, we take for the first partial dividend 76. Then $76 \div 9 = 8$ with remainder 4, and as 6, the last figure of this dividend, is in the place of tens, we write the quotient 8 in the place of the tens under the 6.

The remainder 4 is 4 tens or 40 ones, and 40 ones put with the 5 ones make 45 ones.

Then $45 \div 9 = 5$.

The quotient, therefore, is 8 tens and 5 ones; that is, 85.

Divide by 2:

468	456	372	332	634	972
326	254	214	548	418	908

Divide by 3:

354	365	624	484	408	798
444	235	651	790	891	976

Divide by 4:

924	824	956	564	592	918
752	912	734	723	712	513

Divide by 5:

510	520	640	770	590	745
665	735	560	880	620	825

Divide by 6:

666	636	732	726	822	924
624	720	744	810	846	933

Divide by 7:

728	784	812	861	910	945
742	797	805	875	931	952

Divide by 8:

808	832	912	336	416	256
816	840	920	352	424	264

Divide by 9:

927	945	405	378	288	135
936	918	396	387	297	225

LESSON 4.

ORAL EXERCISES.

If 3 cords of wood cost $9, what will 4 cords cost?

NOTE. Require the pupil to analyze this and similar problems by the **unitary method.** Thus, if 3 cords cost $9, 1 cord will cost ⅓ of $9, or $3; and 4 cords will cost 4 × $3, or $12.

If 4 men can mow a field in 6 days, how many days will it take 3 men to mow the field?

Analysis. If it takes 4 men 6 days to mow a field, it will take 1 man 4 × 6 days, or 24 days; if it takes 1 man 24 days to mow a field, it will take 3 men ⅓ of 24 days, or 8 days.

Find the cost of 7 barrels of flour, if 8 barrels cost $40.

Find the cost of 12 oranges, if 5 oranges cost 15 cents.

What will 12 lambs cost, if 3 lambs cost $12?

If 12 men can dig a certain ditch in 6 days, how many men will be required to dig the ditch in 8 days?

If 8 pounds of sugar cost 40 cents, how many cents will 11 pounds cost?

If 3 tons of coal cost $21, how much will 8 tons cost?

If 4 men can build a wall in 5 days, how many men will be required to build it in 4 days?

If 3 yards of cloth are worth $6, how much are 7 yards worth?

If 2 lamps cost $8, what will 5 lamps cost?

If 9 yards of muslin costs 63 cents, what will 8 yards cost?

If 8 men can do a piece of work in 9 days, how many days will it take 6 men to do it?

How many pounds of butter at 20 cents a pound must be given for 2 pounds of tea at 60 cents a pound?

A man bought eggs at the rate of 4 dozen for 72 cents, and sold them at the rate of 5 dozen for a dollar. How much did he make on a dozen?

SHORT DIVISION.

When the divisor is so small that the work can be performed mentally, the process is called **short division.**

The *proof* of division is as follows: Find the product of the divisor and quotient, and to this product add the remainder. The result should be equal to the dividend.

Divide 63169 by 7.

$$7\overline{)63169}$$

9024 with rem. 1.

WORDING: 7 in 63, **9**; in 1, **0**; in 16 **2**; in 29, **4**; with rem. 1.

EXPLANATION: Since 7 is not contained in 6, we take two figures 63 for the *first partial dividend*, and write the quotient 9 under the *right-hand figure* 3 of this partial dividend. 7 is not contained in 1, so 0 is written as the second figure of the quotient, and this 1, which is equal to 10 units of the next lower order of units, is joined to the 6, and makes 16 for the next partial dividend. Then 16 is divided by 7; the quotient is 2 and the remainder 2; the remainder 2 is equal to 20 of the next lower order of units, and with the 9 makes 29. Then 29 is divided by 7; the quotient is 4 and the remainder 1. Therefore the quotient is 9024, and the remainder is 1.

Proof.

$$\begin{array}{r} 9024 \\ \times\ \ 7 \\ \hline 63168 \\ +\ \ 1 \\ \hline 63169 \end{array}$$

The product of the divisor and quotient is 63168.

To this product add the remainder 1, and the result is 63169, the same as the dividend.

Divide \$54322 by \$9.

$$\$9\overline{)\$54322}$$

6035 with 7 rem.

In this example we are required to find the *number of times* we can take away \$9 from \$54322. The answer is 6035 *times*, with \$7 over. The complete quotient may be written $6035\frac{7}{9}$.

Divide \$54322 by 9.

$$9\overline{)\$54322}$$

\$6035 with \$7 rem.

In this example we are required to divide \$54322 into *nine equal parts*, and to find the *number of dollars* in each part. The answer is 6035 *dollars*, with \$7 over. The answer may be written $\$6035\frac{7}{9}$.

The last two examples illustrate the different meanings of division. *If the divisor and dividend refer to the same kind of units*, the quotient denotes the *number of times* the divisor must be taken to equal the dividend. If the divisor is *an abstract number* as 2, 3, 4, etc., the quotient denotes *a number of units of the same kind as the units of the dividend.*

Divide:

1. 434 by 2.
2. 876 by 3.
3. 596 by 4.
4. 432 by 4.
5. 180 by 5.
6. 715 by 5.
7. 875 by 5.
8. 618 by 6.
9. 324 by 6.
10. 819 by 7.
11. 847 by 7.
12. 920 by 8.
13. 904 by 8.
14. 945 by 9.
15. 621 by 9.
16. 513 by 2.
17. 707 by 3.
18. 845 by 4.
19. 901 by 5.
20. 862 by 6.
21. 872 by 7.
22. 907 by 9.
23. 5794 by 2.
24. 5874 by 3.
25. 5696 by 4.
26. 8975 by 5.
27. 3354 by 6.
28. 1176 by 7.
29. 8568 by 8.
30. 2943 by 9.
31. 3711 by 2.
32. 3226 by 3.
33. 8467 by 4.
34. 9573 by 5.
35. 6983 by 6.
36. 8659 by 7.
37. 4329 by 8.
38. 8256 by 9.
39. 5879 by 3.
40. 7361 by 9.
41. 6539 by 8.
42. 5396 by 7.
43. 9751 by 3.
44. 6857 by 7.
45. 95874 by 2.
46. 45873 by 3.
47. 46372 by 4.
48. 78295 by 5.
49. 66372 by 6.
50. 92582 by 7.
51. 87824 by 8.
52. 98172 by 9.
53. 78956 by 7.
54. 65978 by 8.
55. 76598 by 6.
56. 83621 by 3.
57. 86123 by 6.
58. 38612 by 9.
59. 12386 by 7.
60. 50080 by 8.
61. 65387 by 7.
62. 75429 by 5.
63. 31285 by 6.
64. 29514 by 9.
65. 65387 by 8.
66. 57148 by 3.

LONG DIVISION.

The process of Long Division is the same as that of Short Division, except that the work is written in full, and the quotient is written *over* the dividend.

Divide 31864 by 87.

The beginner will find it convenient to form a table of products of the divisor by the numbers 1, 2, 3, ..., as follows:

$1 \times 87 = 87$	$4 \times 87 = 348$	$7 \times 87 = 609$
$2 \times 87 = 174$	$5 \times 87 = 435$	$8 \times 87 = 696$
$3 \times 87 = 261$	$6 \times 87 = 522$	$9 \times 87 = 783$

As 87 is more than 31, it is necessary to take *three* figures of the dividend for the first partial dividend. Of the products in the table that do not exceed 318, the greatest is 261; that is, 3×87. Hence the first quotient figure is 3, and is written over the 8, the *right-hand figure* of the first partial dividend; then 261 is subtracted from 318. To the remainder 57, the next figure 6 of the dividend is annexed. Of the products that do not exceed 576, the greatest is 522; that is, 6×87. Hence 6 is the next figure of the quotient, and the next remainder is 54, to which the 4 of the dividend is annexed. Of the products that do not exceed 544, the greatest is 522; that is, 6×87. Hence the next figure of the quotient is 6, and the remainder 22. Therefore the quotient is 366, and the remainder 22.

OPERATION.

```
   366
87)31864
   261
   576
   522
   544
   522
    22 rem.
```

After a little practice the operation of division can be performed without the aid of a table of products.

If at any step the product is greater than the partial dividend, the number denoted by the quotient-figure is too large and must be diminished; if the remainder is greater than the divisor, the number denoted by the quotient-figure is too small and must be increased.

Divide 1006078 by 247.

OPERATION.

$$\begin{array}{r} 4073 \\ 247)\overline{1006078} \\ 988 \\ \hline 1807 \\ 1729 \\ \hline 788 \\ 741 \\ \hline 47 \text{ rem.} \end{array}$$

The first partial dividend is 1006. We find that 5×247 is 1235, which is greater than 1006, and therefore 5 is too large. We try 4, and find that 4×247 is 988. We write the 4 over the 6, the right-hand figure of the partial dividend, and subtract the 988 from 1006. To the remainder 18 we annex 0, the next figure of the dividend, and have 180. Since 247 is not contained in 180, we write 0 for the next figure of the quotient, and annex to 180 the next figure of the dividend, 7. The next figure of the quotient is not 9, for $9 \times 247 = 2223$, and is not 8, for $8 \times 247 = 1976$, and each of these products is greater than 1807. We try 7, and find the product to be 1729, which is less than 1807. The remainder obtained by subtracting 1729 from 1807 is 78, to which we annex the 8 of the dividend, and have 788. The next figure of the quotient is 3, and the product of 3×247 is 741. Subtracting 741 from 788 we get 47 for the remainder of the division. Hence the quotient is 4073, and the remainder 47.

Divide:

1. 5938 by 36.	**13.** 8757 by 67.	**25.** 8332 by 71.
2. 5743 by 37.	**14.** 9212 by 91.	**26.** 9888 by 93.
3. 9853 by 49.	**15.** 2786 by 22.	**27.** 7112 by 43.
4. 7369 by 52.	**16.** 3764 by 29.	**28.** 2931 by 19.
5. 9423 by 63.	**17.** 6753 by 57.	**29.** 9213 by 29.
6. 6578 by 74.	**18.** 9362 by 89.	**30.** 8778 by 55.
7. 6457 by 59.	**19.** 8579 by 73.	**31.** 61238 by 101.
8. 3579 by 21.	**20.** 8957 by 79.	**32.** 86123 by 201.
9. 7436 by 34.	**21.** 7319 by 53.	**33.** 38612 by 302.
10. 4589 by 42.	**22.** 8609 by 61.	**34.** 23816 by 205.
11. 5936 by 47.	**23.** 6891 by 31.	**35.** 12386 by 502.
12. 8372 by 65.	**24.** 3954 by 23.	**36.** 83216 by 603.

1. 98245 by 704.
2. 59824 by 215.
3. 45982 by 316.
4. 82459 by 638.
5. 93827 by 859.
6. 96548 by 789.
7. 84596 by 627.
8. 23469 by 295.
9. 24963 by 468.
10. 59376 by 261.
11. 56379 by 237.
12. 79476 by 732.
13. 67532 by 557.
14. 70456 by 678.
15. 80026 by 709.
16. 72345 by 567.
17. 90365 by 463.
18. 78659 by 741.
19. 94158 by 429.
20. 48519 by 229.
21. 67857 by 479.
22. 99321 by 912.
23. 79132 by 811.
24. 83742 by 566.
25. 650734 by 537.
26. 732065 by 631.
27. 704523 by 873.
28. 200836 by 897.
29. 650734 by 635.
30. 573206 by 753.
31. 732065 by 537.
32. 723540 by 871.
33. 680023 by 997.
34. 650734 by 736.
35. 572036 by 853.
36. 704532 by 973.
37. 432960 by 187.
38. 349062 by 259.
39. 802365 by 795.
40. 690409 by 389.
41. 109370 by 167.
42. 963047 by 398.
43. 750431 by 578.
44. 895047 by 757.
45. 938704 by 198.
46. 618543 by 4021.
47. 816354 by 2008.
48. 543168 by 4307.
49. 604307 by 4803.
50. 729718 by 5184.
51. 542385 by 4978.
52. 604730 by 4758.
53. 817279 by 9814.
54. 729718 by 4918.

DIVISION OF DECIMALS.

In Division, if the dividend and divisor are both multiplied or both divided by the same number, the quotient is not changed. Thus, $18 \div 6 = 3$, and (when both dividend and divisor are multiplied by 2) $36 \div 12 = 3$. Again (when both dividend and divisor are divided by 2), $9 \div 3 = 3$.

If the divisor is a whole number, and the dividend has decimals: *Divide as in whole numbers, but write the decimal point in the quotient as soon as the decimal point in the dividend is reached.*

Divide 1.29 by 3.

3)1.29
0.43

Since 3 is not contained in 1, we write 0 under the 1; then the decimal point, and afterwards we continue, 3 in 12, **4**; 3 in 9, **3**. The quotient is 43 *hundredths*.

If the divisor has decimals, and the dividend is a whole number: *Annex as many zeros to the dividend as there are decimal places in the divisor, and remove the decimal point from the divisor.*

Divide 129 by 0.2.

2)1290
645

Here we add 0 to the 129, making 1290, and divide by 2; in other words, we multiply both dividend and divisor by 10.

If both the divisor and dividend have decimals: *Remove the decimal point from the divisor, and move the decimal point in the dividend to the right as many places as there are decimals in the divisor.*

Divide 1.29 by 0.3.

3)12.9
4.3

Here we carry the decimal point in the dividend one place to the right, and remove it from the divisor. In other words, we multiply both dividend and divisor by 10.

Divide 28.3696 by 1.49.

OPERATION.

$$
\begin{array}{r}
19.04 \\
149\overline{)2836.96} \\
\underline{149} \\
1346 \\
\underline{1341} \\
596 \\
\underline{596}
\end{array}
$$

Here the decimal point is removed from the divisor, and is moved two places to the right in the dividend; in other words, both dividend and divisor are multiplied by 100.

Find the quotients of

1. $80.24 \div 8$.
2. $12.5664 \div 4$.
3. $1301.4 \div 241$.
4. $2647.08 \div 324$.
5. $9.215 \div 0.08$.
6. $664.56 \div 0.18$.
7. $132.6 \div 425$.
8. $7.48 \div 0.085$.
9. $0.748 \div 44$.
10. $2878.2 \div 369$.
11. $2.3328 \div 0.36$.
12. $52.5 \div 0.025$.
13. $1521 \div 11.7$.
14. $7236 \div 1.44$.
15. $67288 \div 64.7$.
16. $73807 \div 0.023$.
17. $300 \div 0.015$.
18. $32 \div 0.064$.
19. $2.88 \div 0.0024$.
20. $6.2 \div 0.0025$.
21. $65.1021 \div 3.207$.
22. $7704.256 \div 928$.
23. $506.016 \div 753$.
24. $1.9248 \div 0.008$.
25. $62825 \div 1.75$.
26. $700727 \div 0.029$.
27. $276.766 \div 37.1$.
28. $0.1024 \div 2.56$.
29. $1024 \div 25.6$.
30. $1292 \div 3.23$.
31. $906.5 \div 0.185$.
32. $0.4496 \div 11.24$.

SLATE EXERCISES.

1. A box contains 1416 eggs. How many dozen eggs are there in the box?

2. If 13 yards of velvet cost $97.50, what is the price of one yard?

3. If $38,057 are divided into 19 equal parts, how many dollars will there be in each part?

4. How many times is the sum of $17 contained in $2890?

5. There are 320 rods in a mile. How many miles are there in 9280 rods?

6. At $16.50 a ton, how many tons of hay can be bought for $280.50?

7. At $5.75 a ton, how many tons of coal can be bought for $103.50?

8. At 24 cents a dozen, how many dozen eggs can be bought for $61.44?

9. I bought 96 shares of railroad stock for $12,000. How much did the stock cost a share?

10. If a field produces 4905 bushels of corn, producing on the average 45 bushels to the acre, how many acres does the field contain?

11. At $10.50 a ton, how many tons of plaster can be bought for $65.625?

12. A man bought a barrel of sugar, weighing 232 pounds, for $12.76. How many cents a pound did he pay for the sugar?

13. When the price of Messina oranges is $2.75 a box, how many boxes can be bought for $77?

14. In how many hours will a cistern holding 4200 gallons be filled by a pipe that discharges into it 175 gallons an hour?

If the divisor is not contained in the dividend without a remainder, zeros may be annexed to the dividend, and the division continued.

Divide 0.39842 by 3.7164 to four decimal places.

OPERATION.

$$
\begin{array}{r}
0.1072 \\
37164\overline{)\,3984.2} \\
3716\,4 \\
\hline
267800 \\
260148 \\
\hline
76520 \\
74328 \\
\hline
2192
\end{array}
$$

If the divisor is a whole number, and ends in zeros. *Cut off the zeros from the divisor, and move the decimal point in the dividend as many places to the left (prefixing zeros if necessary), as there are zeros cut off.*

Divide 42.08 by 8000.

OPERATION.

$$
\begin{array}{r}
8\overline{)\,0.04208} \\
\hline
0.00526
\end{array}
$$

Here the three zeros are cut off from the divisor, and the decimal point in the dividend is moved three places to the left. In other words, both divisor and dividend are divided by 1000.

SLATE EXERCISES.

Divide to four decimal places:

1. 5.8 by 4.79.
2. 7.34 by 2.3.
3. 16.28 by 0.67.
4. 54.87 by 0.39.
5. 2.86 by 349.
6. 8.6 by 3000.
7. 95 by 7000.
8. 89 by 6700.
9. 0.32 by 410.
10. 0.51 by 3700.

SLATE EXERCISES.

1. The production of pig-iron in the United States for the census year of 1890 was 9,579,779 tons, and 3,781,-021 tons for the census year of 1880. Find the increase.

2. In 1880 Alabama produced 62,336 tons of pig-iron, and 890,432 tons in 1890. How many times the production of 1880 is the production of 1890?

3. The production of steel rails in the United States in 1880 was 741,475 tons, and 2,036,654 tons in 1890. Find the increase.

4. The value of wool manufactures in the United States for the census year of 1890 was $337,768,524; of cotton manufactures $267,981,724; of silk manufactures $87,298,454. Find the total value of the products of these three industries.

5. Find the difference in value between the wool and the cotton manufactures of the United States in 1890.

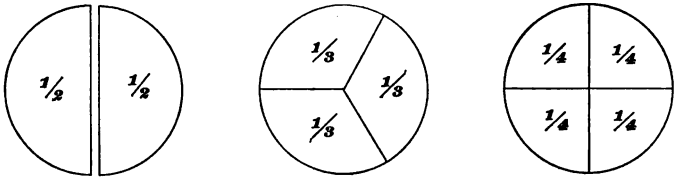
6. The total area devoted to the cultivation of cereals in the New England States in 1889 was 580,297 acres, and in 1879 the total area was 746,128 acres. Find the decrease.

7. In 1889 New Hampshire raised 988,806 bushels of Indian corn from 23,746 acres. Find to two places of decimals the average number of bushels per acre.

8. In 1889 Iowa raised 313,130,782 bushels of Indian corn from 7,585,522 acres. Find to the nearest bushel the average number of bushels per acre.

9. In 1889 the United States raised 468,321,424 bushels of wheat from 33,575,898 acres. Find to the nearest bushel the average number of bushels per acre.

COMMON FRACTIONS.



If a circle is divided into 2 equal parts,

What part of the whole circle is each of these parts?
What part of the whole circle are 2 of these parts?

If a circle is divided into 3 equal parts,

What part of the whole circle is each of these parts?
What part of the whole circle are 2 of these parts?
What part of the whole circle are 3 of these parts?

If a circle is divided into 4 equal parts,

What part of the whole circle is each of these parts?
What part of the whole circle are 2 of these parts?
What part of the whole circle are 3 of these parts?
What part of the whole circle are 4 of these parts?
How many *halves* of a unit make the whole unit?
How many *thirds* of a unit make the whole unit?
How many *fourths* of a unit make the whole unit?

What is the *name* of one of the parts of a unit,

When the unit is divided into *two equal parts?*
When the unit is divided into *three equal parts?*
When the unit is divided into *four equal parts?*
Which is larger $\frac{1}{2}$ of a circle or $\frac{1}{3}$ of the circle?
Which is larger $\frac{1}{2}$ of a circle or $\frac{1}{4}$ of the circle?
Which is larger $\frac{1}{3}$ of a circle or $\frac{1}{4}$ of the circle?

To change a whole number to an improper fraction: *Multiply the whole number by the required denominator; under the product write the denominator.*

To change a mixed number to an improper fraction: *Multiply the whole number by the given denominator; to this product add the given numerator; under the result write the denominator.*

Change to improper fractions:

1. $8\frac{3}{8}$.	7. $5\frac{5}{24}$.	13. $25\frac{3}{5}$.	19. Change 15 to 6ths.
2. $7\frac{5}{7}$.	8. $3\frac{5}{36}$.	14. $29\frac{10}{11}$.	20. Change 14 to 8ths.
3. $9\frac{8}{9}$.	9. $11\frac{5}{11}$.	15. $31\frac{3}{16}$.	21. Change 25 to 12ths.
4. $11\frac{3}{4}$.	10. $12\frac{4}{5}$.	16. $14\frac{5}{16}$.	22. Change 36 to 4ths.
5. $7\frac{8}{12}$.	11. $13\frac{5}{13}$.	17. $12\frac{2}{15}$.	23. Change 40 to 36ths.
6. $1\frac{1}{23}$.	12. $17\frac{4}{11}$.	18. $19\frac{5}{12}$.	24. Change 39 to 16ths.

seventeen eighteenths.
nine fourteenths.
nine twentieths.
four twenty-fifths.
thirty thirty-seconds.
thirteen twenty-fourths.
fifteen nineteenths.

Read: $\frac{3}{6}$, $\frac{5}{13}$, $\frac{4}{9}$, $\frac{11}{21}$, $\frac{9}{22}$, $\frac{3}{17}$, $\frac{4}{19}$, $\frac{12}{23}$, $\frac{19}{25}$, $\frac{11}{27}$.

If the numerator is smaller than the denominator, the fraction is called a *proper fraction;* as $\frac{7}{8}$.

If the numerator is equal to the denominator, or greater than the denominator, the fraction is called an *improper fraction;* as $\frac{8}{8}$, $\frac{15}{8}$.

A *mixed number* is a whole number and a fraction; as $5\frac{2}{7}$, read five *and* two-sevenths.

Every common fraction may be regarded as the *quotient* of the numerator divided by the denominator.

Thus, $\frac{7}{9}$ is the exact quotient of 7 divided by 9, just as in dividing 1.29 by 3 we have 0.43 for the exact quotient.

Any standard used in counting or in measuring is called a unit.

In 3 quarters of a yard the **unit** is a *quarter of a yard.* But a quarter of a yard is a *fractional part* of the **integral unit,** a yard.

A unit which is a fractional part of another unit is called a **fractional unit,** and the unit of which it is a part is called **its integral unit.**

Numbers that count integral units are called **integral numbers.** Numbers that count fractional units are called **fractional numbers,** or **fractions.** But it must be noticed that the words *integral* and *fractional,* though applied to numbers, **refer only to the units counted by the numbers.**

Name the fractional unit and the integral unit in:

3 quarters of an inch.	1 half of an hour.
4 fifths of a pound.	6 sevenths of a week.
2 thirds of a yard.	5 twelfths of a foot.
3 eighths of a bushel.	3 sixteenths of a ton.
9 tenths of a dollar.	5 sixths of an acre.

Express:

$\frac{1}{2}$ of a yard in inches.	$\frac{1}{2}$ of a pound in ounces.
$\frac{2}{3}$ of a yard in inches.	$\frac{3}{4}$ of a pound in ounces.
$\frac{3}{4}$ of a yard in inches.	$\frac{3}{8}$ of a pound in ounces.
$\frac{5}{6}$ of a yard in inches.	$\frac{5}{8}$ of a pound in ounces.

Every common fraction is written in figures by means of two whole numbers, which are called the **terms** of the fraction.

One of these gives the *name* of the parts, and is called the **denominator;** and the other gives the *number* of the parts taken, and is called the **numerator.**

REDUCTION OF FRACTIONS TO LOWER TERMS.

If both terms of a fraction are divided by the same number, the value of the fraction is not altered.

By this operation we decrease the *number* and increase the *size* of the parts at the same rate. If we divide both terms of $\frac{8}{14}$ by 2, we get $\frac{4}{7}$; we *halve the number* and *double the size* of the parts.

Reduce $\frac{35}{42}$ to an equivalent fraction with 6 for its denominator.

Here we must find the divisor which, with 42 for dividend, will give 6 for the quotient.

To find this divisor we must divide 42 by 6, and this gives 7. Hence 7 is the divisor by which we must divide both terms of $\frac{35}{42}$. The resulting fraction is $\frac{5}{6}$. Hence,

4.	[illegible]	[illegible]	[illegible]	[illegible]
5. $7\frac{8}{12}$.	11. $13\frac{5}{13}$.	17. $12\frac{2}{15}$.	23. Change 40 to 36ths.	
6. $1\frac{1}{28}$.	12. $17\frac{4}{11}$.	18. $19\frac{5}{12}$.	24. Change 39 to 16ths.	

[illegible] seventeen eighteenths.
nine fourteenths. thirty thirty-seconds.
nine twentieths. thirteen twenty-fourths.
four twenty-fifths. fifteen nineteenths.

Read: $\frac{8}{6}$, $\frac{5}{13}$, $\frac{4}{9}$, $\frac{11}{21}$, $\frac{9}{22}$, $\frac{3}{17}$, $\frac{4}{19}$, $\frac{12}{23}$, $\frac{19}{25}$, $\frac{11}{27}$.

If the numerator is smaller than the denominator, the fraction is called a *proper fraction;* as $\frac{7}{8}$.

If the numerator is equal to the denominator, or greater than the denominator, the fraction is called an *improper fraction;* as $\frac{8}{8}$, $\frac{15}{8}$.

A *mixed number* is a whole number and a fraction; as $5\frac{2}{7}$, read five *and* two-sevenths.

Every common fraction may be regarded as the *quotient* of the numerator divided by the denominator.

Thus, $\frac{7}{9}$ is the exact quotient of 7 divided by 9, just as in dividing 1.29 by 3 we have 0.43 for the exact quotient.

MULTIPLES OF A NUMBER.

The *product* of two or more integral factors is called a **multiple** of each of the factors.

A multiple of two or more integral numbers is called a **common multiple** of the numbers.

The *least* of the common multiples of two or more numbers is called their **least common multiple.**

The least common multiple of two or more numbers must contain all the integral factors of each of the numbers, otherwise it will not be a multiple of all the numbers.

Find the least common multiple of 16, 24, and 30.

$16 = 2 \times 2 \times 2 \times 2.$
$24 = 2 \times 2 \times 2 \times 3.$
$30 = 2 \times 3 \times 5.$

The different integral factors are 2, 3, and 5; but 2 occurs 4 times in 16, the greatest number of times it occurs in any one of the given numbers, 3 occurs only once in any of them, and 5 only once. Hence the least common multiple is $2 \times 2 \times 2 \times 2 \times 3 \times 5 = 240$. Therefore,

To find the least common multiple of two or more numbers:

Resolve each number into its prime factors.

Select the different factors, taking each factor the greatest number of times it is found in any of the given numbers; and the product of the factors thus selected will be the least common multiple.

Find the least common multiple of

1. 12 and 21.
2. 21 and 28.
3. 16 and 40.
4. 36 and 42.
5. 15 and 25.
6. 34 and 51.
7. 24, 63, and 84.
8. 20, 36, and 54.
9. 6, 9, and 24.
10. 32, 36, and 56.

SIMILAR FRACTIONS.

If both terms of a fraction are multiplied by the same number, the value of the fraction is not altered.

By this operation the *number* of parts is increased, and the *size* of the parts is decreased, at the same rate.

Fractions that have a common denominator are called *similar fractions*.

Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ to similar fractions.

We first find the least common multiple of the denominators 2, 3, and 4, for a common denominator. This is 12. We then find the required numerators by dividing 12 by the denominator of the first fraction and multiplying the result by the numerator of the first fraction; and so proceed with each of the given fractions. Thus,

$12 \div 2 = 6$, and $1 \times 6 = 6$. Therefore $\frac{1}{2} = \frac{6}{12}$.
$12 \div 3 = 4$, and $2 \times 4 = 8$. Therefore $\frac{2}{3} = \frac{8}{12}$.
$12 \div 4 = 3$, and $3 \times 3 = 9$. Therefore $\frac{3}{4} = \frac{9}{12}$.

Hence the required fractions are $\frac{6}{12}$, $\frac{8}{12}$, $\frac{9}{12}$. Therefore,

To reduce fractions to similar fractions:

Find the least common multiple of the denominators, and this will be the common denominator.

For the required numerators divide the common denominator by the denominator of the first fraction, and multiply the quotient by its numerator; and so proceed for each of the given fractions.

Reduce to similar fractions:

1. $\frac{1}{3}$, $\frac{3}{4}$, $\frac{5}{6}$.
2. $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{12}$.
3. $\frac{1}{2}$, $\frac{2}{9}$, $\frac{5}{6}$.
4. $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$.
5. $\frac{1}{3}$, $\frac{5}{9}$, $\frac{7}{18}$.
6. $\frac{2}{3}$, $\frac{3}{8}$, $\frac{5}{24}$.
7. $\frac{1}{2}$, $\frac{5}{7}$, $\frac{3}{14}$.
8. $\frac{1}{3}$, $\frac{3}{7}$, $\frac{4}{21}$.
9. $\frac{1}{5}$, $\frac{1}{3}$, $\frac{8}{15}$.
10. $\frac{3}{9}$, $\frac{5}{7}$, $\frac{9}{14}$.
11. $\frac{5}{8}$, $\frac{5}{6}$, $\frac{5}{24}$.
12. $\frac{5}{21}$, $\frac{11}{28}$, $\frac{2}{7}$.
13. $\frac{5}{12}$, $\frac{7}{36}$, $\frac{5}{8}$.
14. $\frac{2}{9}$, $\frac{3}{14}$, $\frac{5}{42}$.
15. $\frac{3}{5}$, $\frac{7}{15}$, $\frac{8}{25}$.

ADDITION OF FRACTIONS.

Add $\frac{1}{6}$, $\frac{1}{3}$, $\frac{3}{4}$.

These fractions changed to similar fractions become $\frac{2}{12}$, $\frac{4}{12}$, $\frac{9}{12}$, and $\frac{2}{12} + \frac{4}{12} + \frac{9}{12} = \frac{15}{12}$.

But $\frac{15}{12} = \frac{5}{4} = 1\frac{1}{4}$. Therefore,

To add fractions:

Change the fractions to similar fractions (if they are not similar), and write the sum of the numerators of the similar fractions over the common denominator.

Reduce the resulting fraction to its lowest terms; and if it is an improper fraction, reduce it to a whole or mixed number.

Change to similar fractions and add:

$\frac{1}{2}+\frac{1}{4}=\frac{}{4}$	$\frac{1}{3}+\frac{1}{4}=\frac{}{12}$	$\frac{1}{4}+\frac{1}{6}=\frac{}{12}$	$\frac{1}{6}+\frac{1}{9}=\frac{}{18}$
$\frac{1}{2}+\frac{1}{8}=\frac{}{8}$	$\frac{1}{3}+\frac{1}{5}=\frac{}{20}$	$\frac{1}{4}+\frac{1}{8}=\frac{}{8}$	$\frac{1}{6}+\frac{1}{12}=\frac{}{12}$
$\frac{1}{2}+\frac{1}{3}=\frac{}{6}$	$\frac{1}{3}+\frac{1}{6}=\frac{}{6}$	$\frac{1}{4}+\frac{1}{10}=\frac{}{20}$	$\frac{1}{6}+\frac{1}{8}=\frac{}{24}$
$\frac{1}{2}+\frac{1}{6}=\frac{}{6}$	$\frac{1}{3}+\frac{1}{12}=\frac{}{12}$	$\frac{1}{4}+\frac{1}{12}=\frac{}{12}$	$\frac{1}{9}+\frac{1}{3}=\frac{}{9}$
$\frac{1}{1}+\frac{1}{5}=\frac{}{10}$	$\frac{1}{4}+\frac{1}{5}=\frac{}{20}$	$\frac{1}{4}+\frac{1}{16}=\frac{}{16}$	$\frac{1}{3}+\frac{1}{8}=\frac{}{24}$

$\frac{1}{2}=\frac{}{6}$	$\frac{1}{2}=\frac{}{8}$	$\frac{1}{2}=\frac{}{10}$	$\frac{1}{2}=\frac{}{12}$	$\frac{1}{2}=\frac{}{12}$
$\frac{1}{3}=\frac{}{6}$	$\frac{1}{4}=\frac{}{8}$	$\frac{1}{5}=\frac{}{10}$	$\frac{1}{6}=\frac{}{12}$	$\frac{1}{4}=\frac{}{12}$
$\frac{1}{6}=\frac{}{6}$	$\frac{1}{8}=\frac{}{8}$	$\frac{1}{10}=\frac{}{10}$	$\frac{1}{12}=\frac{}{12}$	$\frac{1}{12}=\frac{}{12}$

$\frac{1}{2}=\frac{}{16}$	$\frac{1}{4}=\frac{}{12}$	$\frac{1}{3}=\frac{}{12}$	$\frac{1}{3}=\frac{}{18}$	$\frac{1}{3}=\frac{}{12}$
$\frac{1}{8}=\frac{}{16}$	$\frac{1}{3}=\frac{}{12}$	$\frac{1}{6}=\frac{}{12}$	$\frac{1}{6}=\frac{}{18}$	$\frac{1}{4}=\frac{}{12}$
$\frac{1}{16}=\frac{}{16}$	$\frac{1}{12}=\frac{}{12}$	$\frac{1}{12}=\frac{}{12}$	$\frac{1}{9}=\frac{}{18}$	$\frac{1}{6}=\frac{}{12}$

$\frac{1}{2}=\frac{}{12}$	$\frac{1}{4}=\frac{}{12}$	$\frac{1}{2}=\frac{}{24}$	$\frac{1}{6}=\frac{}{24}$	$\frac{1}{6}=\frac{}{36}$
$\frac{1}{3}=\frac{}{12}$	$\frac{1}{3}=\frac{}{12}$	$\frac{1}{3}=\frac{}{24}$	$\frac{1}{8}=\frac{}{24}$	$\frac{1}{9}=\frac{}{36}$
$\frac{1}{9}=\frac{}{12}$	$\frac{1}{6}=\frac{}{12}$	$\frac{1}{8}=\frac{}{24}$	$\frac{1}{12}=\frac{}{24}$	$\frac{1}{4}=\frac{}{36}$

ADDITION OF MIXED NUMBERS.

Add $6\frac{5}{9}$, $4\frac{5}{6}$, $3\frac{1}{2}$.

OPERATION.

$6\frac{5}{9}$ $\frac{10}{18}$
$4\frac{5}{6}$ $\frac{15}{18}$
$3\frac{1}{2}$ $\frac{9}{18}$
$14\frac{8}{9}$ $\frac{34}{18}=\frac{17}{9}=1\frac{8}{9}$.

Adding the fractions, we have

$\frac{5}{9}=\frac{10}{18}$, $\frac{5}{6}=\frac{15}{18}$, $\frac{1}{2}=\frac{9}{18}$, and

$\frac{10}{18}+\frac{15}{18}+\frac{9}{18}=\frac{34}{18}=1\frac{16}{18}=1\frac{8}{9}$.

Write the $\frac{8}{9}$ under the fractions, and add the 1 with the integral numbers.

Therefore,

To add mixed numbers:

Add the fractions first, and then the whole numbers, and write the sum of the two results.

SLATE EXERCISES.

Add:

1. $4\frac{1}{2}$, $3\frac{1}{4}$, $5\frac{1}{8}$
2. $9\frac{1}{2}$, $8\frac{1}{6}$, $6\frac{1}{12}$
3. $6\frac{1}{3}$, $6\frac{1}{4}$, $6\frac{1}{6}$
4. $7\frac{1}{3}$, $9\frac{1}{6}$, $8\frac{1}{12}$
5. $8\frac{1}{7}$, $7\frac{1}{14}$, $5\frac{1}{2}$
6. $9\frac{1}{3}$, $9\frac{1}{5}$, $9\frac{1}{15}$
7. $17\frac{1}{4}$, $29\frac{1}{5}$, $37\frac{1}{10}$
8. $95\frac{1}{18}$, $37\frac{1}{9}$, $68\frac{1}{2}$
9. $76\frac{1}{3}$, $97\frac{1}{5}$, $84\frac{1}{15}$
10. $87\frac{1}{4}$, $78\frac{1}{3}$, $96\frac{1}{2}$

11. $\frac{5}{12}$, $\frac{7}{12}$, $\frac{11}{12}$.
12. $\frac{7}{36}$, $\frac{21}{36}$, $\frac{31}{36}$.
13. $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$.
14. $\frac{2}{3}$, $\frac{5}{6}$, $\frac{7}{12}$.
15. $\frac{3}{4}$, $\frac{5}{8}$, $\frac{7}{10}$.
16. $\frac{11}{12}$, $\frac{8}{9}$, $\frac{1}{2}$.
17. $\frac{1}{12}$, $\frac{3}{4}$, $\frac{5}{6}$.
18. $\frac{2}{3}$, $\frac{3}{4}$, $\frac{7}{8}$.
19. $\frac{5}{9}$, $\frac{5}{12}$, $\frac{7}{18}$.
20. $\frac{5}{7}$, $\frac{8}{21}$, $\frac{5}{6}$.
21. $\frac{1}{8}$, $\frac{5}{6}$, $\frac{3}{4}$.
22. $\frac{4}{5}$, $\frac{7}{15}$, $\frac{9}{10}$.
23. $3\frac{2}{3}$, $2\frac{1}{4}$, $1\frac{1}{2}$.
24. $7\frac{5}{12}$, $6\frac{1}{4}$, $7\frac{5}{6}$.
25. $4\frac{3}{4}$, $5\frac{1}{8}$, $8\frac{1}{2}$.
26. $9\frac{1}{4}$, $4\frac{19}{36}$, $9\frac{7}{12}$.
27. $5\frac{2}{3}$, $8\frac{1}{6}$, $9\frac{1}{4}$, $8\frac{5}{12}$.
28. $9\frac{5}{6}$, $8\frac{11}{21}$, $5\frac{1}{3}$, $3\frac{9}{14}$.
29. $7\frac{1}{2}$, $5\frac{1}{3}$, $9\frac{11}{24}$, $8\frac{5}{6}$.
30. $5\frac{5}{18}$, $7\frac{7}{9}$, $5\frac{1}{4}$, $5\frac{7}{12}$.
31. $3\frac{7}{36}$, $4\frac{5}{18}$, $8\frac{7}{9}$, $6\frac{11}{12}$.

SUBTRACTION OF FRACTIONS.

Subtract $\frac{1}{6}$ from $\frac{3}{4}$.

These fractions changed to similar fractions become $\frac{2}{12}$, $\frac{9}{12}$; and $\frac{9}{12} - \frac{2}{12} = \frac{7}{12}$. Hence,

To subtract one fraction from another:

Change the fractions to similar fractions (if they are not similar); then subtract the numerator of the subtrahend from that of the minuend, and write the remainder over the common denominator.

Reduce the resulting fraction to its lowest terms.

Change to similar fractions and subtract:

$\frac{1}{2} = \frac{\ }{4}$ $\frac{1}{4} = \frac{\ }{4}$	$\frac{1}{2} = \frac{\ }{8}$ $\frac{1}{8} = \frac{\ }{8}$	$\frac{1}{2} = \frac{\ }{6}$ $\frac{1}{6} = \frac{\ }{6}$	$\frac{1}{2} = \frac{\ }{6}$ $\frac{1}{3} = \frac{\ }{6}$	$\frac{1}{3} = \frac{\ }{6}$ $\frac{1}{6} = \frac{\ }{6}$
$\frac{1}{3} = \frac{\ }{9}$ $\frac{1}{9} = \frac{\ }{9}$	$\frac{1}{3} = \frac{\ }{12}$ $\frac{1}{4} = \frac{\ }{12}$	$\frac{1}{3} = \frac{\ }{15}$ $\frac{1}{5} = \frac{\ }{15}$	$\frac{1}{3} = \frac{\ }{12}$ $\frac{1}{12} = \frac{\ }{12}$	$\frac{3}{4} = \frac{\ }{4}$ $\frac{1}{2} = \frac{\ }{4}$
$\frac{2}{8} = \frac{\ }{6}$ $\frac{1}{2} = \frac{\ }{6}$	$\frac{5}{8} = \frac{\ }{8}$ $\frac{1}{2} = \frac{\ }{8}$	$\frac{3}{5} = \frac{\ }{10}$ $\frac{1}{2} = \frac{\ }{10}$	$\frac{4}{5} = \frac{\ }{10}$ $\frac{1}{2} = \frac{\ }{10}$	$\frac{4}{5} = \frac{\ }{20}$ $\frac{3}{4} = \frac{\ }{20}$
$\frac{3}{4} = \frac{\ }{20}$ $\frac{2}{5} = \frac{\ }{20}$	$\frac{3}{5} = \frac{\ }{10}$ $\frac{3}{10} = \frac{\ }{10}$	$\frac{1}{2} = \frac{\ }{10}$ $\frac{2}{5} = \frac{\ }{10}$	$\frac{3}{5} = \frac{\ }{10}$ $\frac{3}{10} = \frac{\ }{10}$	$\frac{7}{10} = \frac{\ }{10}$ $\frac{2}{5} = \frac{\ }{10}$
$\frac{7}{10} = \frac{\ }{10}$ $\frac{2}{5} = \frac{\ }{10}$	$\frac{9}{10} = \frac{\ }{10}$ $\frac{4}{5} = \frac{\ }{10}$	$\frac{15}{16} = \frac{\ }{16}$ $\frac{7}{8} = \frac{\ }{16}$	$\frac{11}{16} = \frac{\ }{16}$ $\frac{1}{4} = \frac{\ }{16}$	$\frac{3}{4} = \frac{\ }{12}$ $\frac{2}{3} = \frac{\ }{12}$
$\frac{1}{4} = \frac{\ }{16}$ $\frac{3}{16} = \frac{\ }{16}$	$\frac{1}{2} = \frac{\ }{16}$ $\frac{7}{16} = \frac{\ }{16}$	$\frac{3}{4} = \frac{\ }{12}$ $\frac{5}{12} = \frac{\ }{12}$	$\frac{5}{6} = \frac{\ }{12}$ $\frac{3}{4} = \frac{\ }{12}$	$\frac{3}{4} = \frac{\ }{12}$ $\frac{2}{3} = \frac{\ }{12}$

SUBTRACTION OF MIXED NUMBERS.

From 8 take $3\frac{5}{12}$.

$8 = 7\frac{12}{12}$, and $7\frac{12}{12} - 3\frac{5}{12} = 4\frac{7}{12}$.

From $7\frac{5}{12}$ take $2\frac{7}{8}$.

OPERATION.

$7\frac{5}{12}$ $\quad \frac{10}{24}$
$2\frac{7}{8}$ $\quad \frac{21}{24}$
$4\frac{13}{24}$

Change $\frac{5}{12}$ and $\frac{7}{8}$ to similar fractions, $\frac{10}{24}$ and $\frac{21}{24}$. Since we cannot subtract 21 from 10, we take 1 from the whole number 7, change this 1 to 24ths, making $\frac{24}{24}$, and add the $\frac{10}{24}$ and $\frac{24}{24}$; the sum is $\frac{34}{24}$. From the $\frac{34}{24}$ we subtract the $\frac{21}{24}$, and have left $\frac{13}{24}$. Then 2 from 6 leaves 4.

Subtract:

1. $9\frac{1}{2}$ $-\frac{1}{3}$	5. $17\frac{2}{3}$ $-9\frac{1}{2}$	9. $15\frac{3}{4}$ $-9\frac{2}{3}$	13. $25\frac{1}{3}$ $-7\frac{1}{9}$	17. $26\frac{1}{6}$ $-7\frac{1}{9}$
2. $3\frac{1}{2}$ $-\frac{1}{4}$	6. $15\frac{3}{5}$ $-9\frac{1}{2}$	10. $14\frac{7}{8}$ $-9\frac{3}{4}$	14. $24\frac{2}{3}$ $-8\frac{4}{9}$	18. $33\frac{7}{8}$ $-8\frac{1}{2}$
3. $2\frac{1}{2}$ $-\frac{3}{8}$	7. $13\frac{3}{4}$ $-9\frac{1}{2}$	11. $17\frac{1}{4}$ $-8\frac{1}{5}$	15. $27\frac{5}{6}$ $-9\frac{1}{3}$	19. $34\frac{6}{7}$ $-5\frac{1}{2}$
4. $1\frac{1}{2}$ $-\frac{2}{5}$	8. $16\frac{7}{12}$ $-9\frac{1}{2}$	12. $23\frac{3}{4}$ $-6\frac{2}{5}$	16. $22\frac{4}{5}$ $-7\frac{3}{4}$	20. $36\frac{7}{10}$ $-7\frac{2}{5}$

21. $1\frac{1}{13} - \frac{5}{13}$.
22. $\frac{5}{6} - \frac{2}{3}$.
23. $\frac{5}{6} - \frac{3}{4}$.
24. $\frac{7}{8} - \frac{5}{6}$.
25. $2\frac{5}{36} - \frac{4}{9}$.
26. $\frac{11}{12} - \frac{7}{8}$.
27. $\frac{15}{16} - \frac{3}{4}$.
28. $\frac{15}{42} - \frac{3}{14}$.
29. $4 - \frac{17}{21}$.
30. $9 - 2\frac{5}{36}$.
31. $11 - \frac{7}{12}$.
32. $15 - \frac{9}{13}$.
33. $3\frac{4}{5} - 3\frac{3}{10}$.
34. $8\frac{2}{5} - 1\frac{3}{4}$.
35. $7\frac{7}{12} - 2\frac{3}{4}$.
36. $9\frac{5}{16} - 5\frac{5}{8}$.
37. $2\frac{3}{9} - 1\frac{5}{18}$.
38. $8\frac{1}{2} - 5\frac{8}{9}$.
39. $5\frac{2}{15} - 3\frac{29}{30}$.
40. $4\frac{5}{7} - 1\frac{17}{21}$.
41. $10\frac{5}{12} - 1\frac{25}{36}$.
42. $11\frac{4}{7} - 3\frac{3}{4}$.
43. $12\frac{9}{10} - 7\frac{14}{15}$.
44. $50\frac{3}{8} - 4\frac{7}{8}$.
45. $18\frac{1}{4} - 3\frac{1}{5}$.
46. $36\frac{5}{8} - 9\frac{3}{4}$.
47. $25\frac{19}{36} - 8\frac{7}{12}$.
48. $19\frac{9}{16} - 7\frac{7}{8}$.
49. $15\frac{4}{25} - 3\frac{3}{50}$.
50. $21\frac{2}{3} - 5\frac{29}{36}$.

MULTIPLICATION OF FRACTIONS.

If we take $\frac{1}{2}$ of $\frac{1}{4}$ of an apple, we have $\frac{1}{8}$ of an apple, and if we take $\frac{1}{2}$ of $\frac{3}{4}$ of an apple, we have $\frac{3}{8}$ of an apple.

That is, $\frac{1}{2}$ of $\frac{1}{4} = \frac{1}{8}$, and $\frac{1}{2}$ of $\frac{3}{4} = \frac{3}{8}$.

But $\frac{1 \times 3}{2 \times 4} = \frac{3}{8}$. Hence,

To multiply one fraction by another:

Take the product of the numerators for the required numerator, and of the denominators for the denominator.

Mixed numbers and whole numbers may be written as improper fractions, and thus brought under the rule.

The work of multiplying fractions may be much shortened by **cancellation**; that is, by dividing out every factor common to the numerator and denominator, before multiplying.

Find the product of $\frac{6}{7}$, $2\frac{4}{5}$, and 3.

Now $2\frac{4}{5} = \frac{14}{5}$, and 3 may be written $\frac{3}{1}$.

Hence the product is $\frac{\overset{2}{\cancel{6}} \times \overset{}{\cancel{14}} \times 3}{\underset{1}{\cancel{7}} \times 5 \times 1} = \frac{36}{5} = 7\frac{1}{5}$.

Cancel the 7 from the denominator and from the 14 in the numerator, and then multiply; we have $\frac{36}{5}$, or $7\frac{1}{5}$.

$\frac{1}{2}$ of $\frac{6}{7} = \frac{}{7}$	$\frac{1}{4}$ of $\frac{8}{9} = \frac{}{9}$	$\frac{1}{6}$ of $\frac{12}{25} = \frac{}{25}$
$\frac{1}{2}$ of $\frac{8}{9} = \frac{}{9}$	$\frac{1}{4}$ of $\frac{12}{13} = \frac{}{13}$	$\frac{1}{6}$ of $\frac{6}{7} = \frac{}{7}$
$\frac{1}{2}$ of $\frac{10}{11} = \frac{}{11}$	$\frac{1}{4}$ of $\frac{16}{20} = \frac{}{20}$	$\frac{1}{6}$ of $\frac{18}{25} = \frac{}{25}$
$\frac{1}{3}$ of $\frac{6}{7} = \frac{}{7}$	$\frac{1}{5}$ of $\frac{10}{11} = \frac{}{11}$	$\frac{1}{8}$ of $\frac{8}{9} = \frac{}{9}$
$\frac{1}{3}$ of $\frac{9}{11} = \frac{}{11}$	$\frac{1}{5}$ of $\frac{15}{16} = \frac{}{16}$	$\frac{1}{8}$ of $\frac{16}{25} = \frac{}{25}$
$\frac{1}{3}$ of $\frac{15}{16} = \frac{}{16}$	$\frac{1}{5}$ of $\frac{20}{21} = \frac{}{21}$	$\frac{1}{7}$ of $\frac{14}{15} = \frac{}{15}$

To multiply a mixed number by a whole number:

Multiply the fraction and then the integral part of the mixed number, and add the results.

Find the products of:

$2 \times 2\frac{1}{2}$	$4 \times 2\frac{1}{3}$	$5 \times 2\frac{1}{5}$	$6 \times 2\frac{1}{2}$
$2 \times 3\frac{1}{2}$	$4 \times 3\frac{1}{4}$	$5 \times 2\frac{2}{5}$	$6 \times 2\frac{1}{3}$
$2 \times 3\frac{1}{3}$	$4 \times 2\frac{1}{3}$	$5 \times 3\frac{3}{5}$	$6 \times 3\frac{1}{3}$
$3 \times 3\frac{1}{3}$	$4 \times 3\frac{1}{2}$	$5 \times 4\frac{4}{5}$	$6 \times 3\frac{1}{2}$
$3 \times 2\frac{1}{6}$	$4 \times 4\frac{1}{7}$	$5 \times 1\frac{1}{3}$	$6 \times 4\frac{1}{6}$
$3 \times 5\frac{1}{5}$	$4 \times 4\frac{1}{5}$	$5 \times 2\frac{1}{6}$	$6 \times 5\frac{1}{7}$
$3 \times 3\frac{1}{6}$	$4 \times 3\frac{2}{9}$	$5 \times 3\frac{2}{10}$	$8 \times 1\frac{1}{2}$

To multiply a whole number by a mixed number.

Multiply the whole number by the fraction first, and then by the integral part of the mixed number, and add the results.

Multiply 8 by $2\frac{1}{3}$.

Here we multiply 8 by $\frac{1}{3}$ and get $2\frac{2}{3}$.
Then we multiply 8 by 2 and get 16.
By adding the $2\frac{2}{3}$ and the 16 we obtain $18\frac{2}{3}$.

$$\begin{array}{r} 8 \\ 2\frac{1}{3} \\ \hline 2\frac{2}{3} \\ 16 \\ \hline 18\frac{2}{3} \end{array}$$

Find the products:

1. $\frac{2}{3}$ of $\frac{5}{6}$.	**6.** $\frac{3}{14} \times 4\frac{2}{5}$.	**11.** $2\frac{1}{2} \times 12$.	**16.** $7\frac{1}{6} \times 21$.
2. $\frac{3}{8}$ of $\frac{4}{9}$.	**7.** $\frac{5}{8} \times 3\frac{3}{7}$.	**12.** $2\frac{3}{4} \times 8$.	**17.** $8\frac{3}{5} \times 22$.
3. $\frac{2}{7} \times 1\frac{4}{3}$.	**8.** $\frac{2}{11} \times 7\frac{6}{7}$.	**13.** $2\frac{2}{3} \times 9$.	**18.** $2\frac{1}{2} \times 6\frac{4}{5}$.
4. $\frac{11}{13} \times \frac{26}{33}$.	**9.** $\frac{5}{9} \times 16\frac{5}{7}$.	**14.** $3\frac{1}{2} \times 20$.	**19.** $3\frac{1}{3} \times 8\frac{1}{4}$.
5. $\frac{3}{8} \times \frac{24}{27}$.	**10.** $2\frac{1}{3} \times 9$.	**15.** $3\frac{5}{6} \times 12$.	**20.** $3\frac{1}{2} \times 6\frac{2}{7}$.

DIVISION OF FRACTIONS.

When the product of two numbers is equal to 1, each of these two numbers is called the *reciprocal* of the other.

Thus, $3 \times \frac{1}{3} = 1$. Here 3 is the reciprocal of $\frac{1}{3}$, and $\frac{1}{3}$ is the reciprocal of 3. Again, $\frac{2}{3} \times \frac{3}{2} = 1$. Here $\frac{2}{3}$ is the reciprocal of $\frac{3}{2}$, and $\frac{3}{2}$ is the reciprocal of $\frac{2}{3}$; that is, the reciprocal of a fraction is the fraction inverted.

To divide by a number is the same as to multiply by the reciprocal of the number.

Thus, to divide by 3 means to separate the dividend into 3 equal parts and to take one of the parts, and to multiply by $\frac{1}{3}$ means to separate the multiplicand into 3 equal parts and to take one of the parts. Hence,

To divide by any number:

Multiply by the reciprocal of the number.

Thus, $\frac{3}{5}$ divided by 2 equals $\frac{3}{5}$ multiplied by $\frac{1}{2}$, equals $\frac{3}{10}$.
$\frac{3}{5}$ divided by $\frac{5}{8}$ equals $\frac{3}{5}$ multiplied by $\frac{8}{5}$, equals $\frac{24}{25}$.

Find the quotients:

1. $\frac{3}{4} \div \frac{3}{2}$.
2. $\frac{2}{3} \div \frac{5}{6}$.
3. $\frac{5}{9} \div \frac{7}{18}$.
4. $12 \div \frac{3}{5}$.
5. $8\frac{1}{2} \div 10$.
6. $6\frac{3}{5} \div \frac{11}{20}$.
7. $3\frac{2}{3} \div 7$.
8. $9\frac{3}{4} \div \frac{13}{20}$.
9. $14\frac{1}{7} \div 4\frac{5}{7}$.
10. $3\frac{3}{8} \div 4\frac{1}{2}$.
11. $19\frac{3}{7} \div 3\frac{5}{21}$.
12. $12\frac{4}{5} \div 2\frac{14}{25}$.
13. $17\frac{1}{7} \div 1\frac{5}{7}$.
14. $71\frac{1}{3} \div 15\frac{2}{7}$.
15. $14\frac{1}{2} \div 9$.
16. $37\frac{4}{5} \div 6$.
17. $125 \div \frac{7}{9}$.
18. $151\frac{2}{3} \div 9\frac{2}{7}$.
19. $\frac{1}{4} \times 2\frac{2}{3} \div \frac{4}{3}$.
20. $\frac{1}{2} \times 3\frac{1}{2} \div \frac{7}{8}$.
21. $3\frac{3}{4} \times \frac{16}{27} \div 2\frac{2}{15}$.
22. $2\frac{1}{4} \times \frac{1}{8} \div \frac{9}{32}$.
23. $6\frac{3}{4} \times \frac{8}{27} \div 2\frac{1}{3}$.
24. $7\frac{1}{4} \times \frac{2}{5} \div 2\frac{7}{11}$.
25. $3\frac{1}{11} \times \frac{1}{17} \div \frac{2}{11}$.
26. $7\frac{3}{4} \div 2\frac{1}{8} \times \frac{17}{31}$.

CONVERSION OF FRACTIONS.

A decimal fraction is a common fraction whose denominator is one of the numbers 10, 100, 1000, etc.

Thus, 0.4 is the same as $\frac{4}{10}$.

To convert a decimal fraction to a common fraction:

Take for the numerator the entire number obtained after removing the decimal point, and for the denominator, 1 *followed by as many zeros as there are decimal places in the original fraction. Reduce the resulting fraction to its lowest terms.*

Thus, $3.25 = \frac{325}{100} = 3\frac{25}{100} = 3\frac{1}{4}$.

To convert a common fraction to a decimal fraction:

Divide the numerator by the denominator.

Thus,
$$\tfrac{1}{8} = 1.000 = 0.125.$$
$$\tfrac{4}{7} = 4.000 = 0.571\tfrac{3}{7}.$$
$$\tfrac{2}{3} = 2.00 = 0.666\tfrac{2}{3}.$$

NOTE. If the division does not terminate at the third decimal place, three decimal places will be sufficiently accurate for most problems. If the number at the *fourth* decimal place is greater than 5, we add 1 to the third decimal figure; if it is equal to 5, we carry the decimal to four places. Thus, $\frac{4}{7} = 0.571$, $\frac{2}{3} = 0.667$, and $\frac{7}{16} = 0.4375$.

Change to common fractions:

1. 0.08.	4. 0.375.	7. 0.425.	10. 3.125.
2. 0.625.	5. 0.004.	8. 0.015.	11. 1.725.
3. 0.032.	6. 0.256.	9. 7.075.	12. 7.875.

Change to decimal fractions:

13. $\frac{3}{50}$.	16. $\frac{1}{25}$.	19. $\frac{1}{250}$.	22. $7\frac{3}{40}$.
14. $\frac{3}{20}$.	17. $\frac{27}{200}$.	20. $17\frac{7}{8}$.	23. $1\frac{15}{16}$.
15. $\frac{1}{40}$.	18. $\frac{4}{125}$.	21. $5\frac{3}{8}$.	24. $5\frac{1}{16}$.

COMPOUND QUANTITIES.

A quantity expressed in a *single unit* is called a **simple quantity**; but a quantity expressed in *different units* is called a **compound quantity.**

Thus, $20\frac{1}{4}$ pounds is a simple quantity, but 20 pounds 4 ounces is a compound quantity.

A unit of greater value or measure than another is said to be of a higher denomination than the other.

Thus the dollar is of a higher denomination than the cent, the pound than the ounce, the yard than the inch, the hour than the minute.

The process of changing the *unit* in which a quantity is expressed, without changing the *value* of the quantity is called **reduction.**

If the change is from a higher unit to a lower, it is called **reduction descending**; if from a lower to a higher, it is called **reduction ascending.**

Thus, 1 yard = 36 inches is an example of reduction descending; and 24 inches = 2 feet is an example of reduction ascending.

LIQUID MEASURE.

Liquid Measure is used in measuring liquids, as water, milk, etc.

TABLE.

4 gills (gi.) = 1 pint (pt.).
2 pints = 1 quart (qt.).
4 quarts = 1 gallon (gal.).

Hence, 1 gal. = 4 qts. = 8 pts. = 32 gi.

$31\frac{1}{2}$ gals. = 1 barrel (bbl.).
63 gals. = 1 hogshead.

NOTE. Casks holding from 28 gals. to 43 gals. are called barrels, and casks holding from 54 gals. to 63 gals. are called hogsheads. If we say, however, that a cistern holds 100 barrels, we mean barrels of $31\frac{1}{2}$ gals. each; or if we say that a cistern holds 100 hogsheads, we mean hogsheads of 63 gals. each.

Reduce 10 gallons 3 quarts 1 pint to pints.

gals.	qts.	pts.
10	3	1
4		
43		
2		
87		

10 gals. = 10 × 4 qts. = 40 qts., and 40 qts. with the 3 qts. added are 43 qts.

43 qts. = 43 × 2 pts. = 86 pts., and 86 pts. with the 1 pt. added are 87 pts.

87 pts. *Ans.*

Rule for reduction descending. *Multiply the number of highest units given by the number of the next lower units required to make one of this higher; add to the product the given number of this lower unit.*

Proceed in this way with each successive result, until the required unit is reached.

Reduce:

1. 5 qts. 3 pts. to pints.
2. 3 qts. 1 pt. to pints.
3. 7 gals. 1 pt. to pints.
4. 1 gal. 1 pt. to gills.
5. 8 gals. 1 pt. to pints.
6. 11 gals. 1 qt. to pints.
7. 2 bbls. to quarts.
8. 3 hhds. to pints.

Reduce 129 pints to higher units.

2 | 129 pts. — 129 pts. = $\frac{1}{2}\frac{2}{9}$ qts. = 64 qts. and 1 pt. over.

4 | 64 qts. . . . 1 pt. — 64 qts. = $\frac{6}{4}\frac{4}{}$ gals. = 16 gals. and 0 qts. over.

16 gals. . . 0 qts.

16 gals. 0 qts. 1 pt. *Ans.*

Rule for reduction ascending. *Divide by the given number of units required to make one of the next higher.*

Divide this quotient, and each successive quotient in like manner, until the required unit is reached.

The last quotient and the several remainders arranged in order is the answer sought.

Reduce to higher units:

9. 229 pints.
10. 51 pints.
11. 365 pints.
12. 442 pints.
13. 1052 pints.
14. 1727 gills.

Add 4 gals. 3 qts. 1 pt.; 11 gals. 1 qt.; 3 qts. 1 pt.; and 25 gals. 2 qts. 1 pt.

gals.	qts.	pts.
4	3	1
11	1	0
	3	1
25	2	1
42	2	1

Write the quantities so that units of the same name shall be in the same column.

The sum of the pints is 3. Divide the 3 pts. by 2 (2 pts. = 1 qt.). The result is 1 qt. and 1 pt. Write the 1 pt. under the column of pints.

The sum of the quarts, including 1 qt. from the 3 pts., is 10. Divide the 10 qts. by 4 (4 qts. = 1 gal.). The result is 2 gals. and 2 qts. Write the 2 qts. under the column of quarts, and add the 2 gals. to the gallons in the column of gallons.

42 gals. 2 qts. 1 pt. *Ans.*

From 4 gals. 2 qts. 1 pt. take 2 gals. 3 qts. 1 pt.

gals.	qts.	pts.
4	2	1
2	3	1
1	3	0

Since 1 pt. − 1 pt. is 0 pt., write 0 under the column of pints.

Since 3 qts. are more than 2 qts., take 1 gal. from the 4 gals., reduce it to quarts, and add them to the 2 qts., making 6 qts. Then, 6 qts. − 3 qts. = 3 qts. Write 3 under the column of quarts. Then 3 gals. − 2 gals. = 1 gal.

1 gal. 3 qts. *Ans.*

Add:

1.

gals.	qts.	pts.
3	1	1
7	3	1
8	3	1

2.

gals.	qts.	pts.
21	3	$1\frac{1}{2}$
18	2	$1\frac{1}{2}$
7	2	1

3.

gals.	qts.	pts.
43	1	1
27	3	1
31	3	$1\frac{1}{2}$

Find the difference between:

4.

gals.	qts.	pts.
21	2	1
7	3	1

5.

gals.	qts.	pts.
18	2	0
7	2	1

6.

gals.	qts.	pts.
27	2	$1\frac{1}{2}$
17	3	1

7. From a barrel that held just 40 gals. and 2 qts. of vinegar there were drawn 19 gals. and 1 pt. How much vinegar was left in the barrel?

Multiply 27 gals. 3 qts. 1 pt. by 5.

gals.	qts.	pts.
27	3	1
		5
139	1	1

5×1 pt. $= 5$ pts. $= 2$ qts. 1 pt. Write the 1 pt. under the pints, and reserve the 2 qts. to be added to the product of 5×3 qts.

5×3 qts. $= 15$ qts., and 15 qts. $+ 2$ qts. $= 17$ qts. $= 4$ gals. 1 qt.

Write the 1 qt. under the quarts and add the 4 gals. to 5×27 gals.

139 gals. 1 qt. 1 pt. *Ans.*

Divide 113 gals. 2 qts. 1 pt. by 6.

	gals.	qts.	pts.
6)	113	2	1
	18	3	$1\frac{1}{2}$

The quotient from dividing 113 gals. by 6 is 18 gals., and the remainder is 5 gals.

Reduce the 5 gals. to quarts, and add them to the 2 qts. The sum is 22 qts.

The quotient from dividing 22 qts. by 6 is 3 qts., and the remainder is 4 qts.

Reduce the 4 qts. to pints, and add them to the 1 pt. The sum is 9 pts. Then 9 pts. $\div 6 = 1\frac{1}{2}$ pts.

18 gal. 3 qt. $1\frac{1}{2}$ pt. *Ans.*

Divide 12 gals. 1 qt. by 3 qts. 1 pt.

12 gals. 1 qt. $= 49$ qts. $= 98$ pts.
3 qts. 1 pt. $= 7$ pts.
and $98 \div 7 = 14$. *Ans.*

Multiply:

1. 7 gals. 3 qts. 1 pt. by 9.
2. 31 gals. 2 qts. by 7.
3. 3 qts. 1 pt. 3 gi. by 8.

Divide:

4. 126 gals. 3 qts. 1 pt. by 6.
5. 110 gals. 1 qt. by 7.
6. 131 gals. by 8.

NOTE. Methods precisely similar to the preceding are employed for the reduction, addition, subtraction, multiplication, and division of *all* compound quantities.

DRY MEASURE.

Dry Measure is used in measuring dry articles, as grain, seeds, fruit, vegetables.

TABLE.

2 pints (pt.) = 1 quart (qt.).
8 quarts = 1 peck (pk.).
4 pecks = 1 bushel (bu.).

Hence 1 bu. = 4 pks. = 32 qts.

NOTE 1. The gallon of liquid measure contains 231 cubic inches. Therefore the quart of liquid measure contains $57\frac{3}{4}$ cu. in. The bushel of dry measure contains 2150.42 cubic inches. Therefore, the quart of dry measure contains $67\frac{1}{5}$ cu. in.

NOTE 2. In measuring grain, seeds, and small fruits, the measure must be *even* full. In measuring apples, potatoes, and other large articles, the measure must be *heaping* full.

1. Reduce 5 bu. 3 pks. 4 qts. to quarts.
2. Reduce 4056 pts. to higher denominations.
3. Multiply 7 bu. 2 pks. 7 qts. by 9.
4. Divide 25 bu. 3 pks. 2 qts. by 7.
5. Divide 1 bu. 3 pks. 7 qts. by 3 qts.
6. Divide 20 bu. 2 pks. by 8.

Add:

7.

bu.	pks.	qts.
5	1	3
3	3	3
7	2	7

8.

bu.	pks.	qts.
8	3	1
9	3	7
9	3	6

9.

bu.	pks.	qts.
121	1	7
156	3	6
132	3	5

Subtract:

10.

bu.	pks.	qts.
5	2	2
3	1	7

11.

bu.	pks.	qts.
8	1	2
4	3	3

12.

bu.	pks.	qts.
150	2	5
136	3	7

AVOIRDUPOIS WEIGHT.

Avoirdupois Weight is used in weighing all articles except gold, silver, and precious stones.

TABLE.

16 ounces (oz.)	= 1 pound (lb.).
2000 pounds	= 1 ton (t.).

The long ton is used in the United States Custom Houses and in wholesale transactions in iron and coal.

112 pounds Avoirdupois = 1 long hundredweight (cwt.).
2240 pounds Avoirdupois = 1 long ton.

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1 pound Avoirdupois = 7000 grains.

NOTE. Many articles are sold by weight, as follows:

1 bu. of wheat or beans	= 60 lbs.	1 bu. of potatoes	= 60 lbs.
1 bu. of corn or rye	= 56 lbs.	1 barrel of flour	= 196 lbs.
1 bu. of corn or rye meal or cr'ked corn	= 50 lbs.	1 barrel of beef or pork	= 200 lbs.
		1 cask of lime	= 240 lbs.
1 bu. of oats	= 32 lbs.	1 quintal of fish	= 100 lbs.
1 bu. of barley	= 48 lbs.	1 stone of iron or lead	= 14 lbs.
1 bu. of timothy seed	= 45 lbs.	1 pig of iron or lead	= 300 lbs.

1. Reduce 3 long tons 12 cwt. 110 lbs. to pounds.
2. Reduce 87,956 lbs. of coal to long tons.
3. Multiply 3 t. 1526 lbs. of hay by 5.
4. Divide 8 t. 1900 lbs. of hay by 7.
5. Add 1 t. 1326 lbs., 1 t. 1560 lbs., 1 t. 1728 lbs.
6. From 2 t. 1015 lbs. take 1526 lbs.
7. From a firkin of butter containing 42 lbs. there were sold 13 lbs. 10 oz. How much was left?
8. At 23 cents a pound, what will 3 lbs. 8 oz. of steak cost? (3 lbs. 8 oz. = $3\frac{1}{2}$ lbs.)
9. At $15 a ton, what will 3 t. 1500 lbs. of hay cost?

TROY WEIGHT.

Troy Weight is used in weighing gold, silver, and precious stones.

TABLE.

24 grains (grs.)	= 1 pennyweight (dwt.).
20 pennyweights	= 1 ounce (oz.).
12 ounces	= 1 pound (lb.).

The pound Troy contains 5760 grs.

1. How many more grains does a pound Avoirdupois contain than a pound Troy?

2. Reduce 8 oz. 12 dwt. to pennyweights.

3. Reduce 1760 dwt. to higher denominations.

4. How many grains are there in an ounce of silver?

5. From 1 lb. Troy take 5 oz. 5 dwt.

6. If 1 dwt. of silver is worth $4\frac{1}{2}$ cents, find the value of an ounce.

7. How many spoons weighing 1 oz. 5 dwt. each can be made from 30 oz. of silver?

8. How many table-spoons weighing 2 oz. 17 dwt. each can be made from 310 oz. 13 dwt. of silver?

9. Divide 373 oz. 2 dwt. by 7.

10. Multiply 27 oz. 13 dwt. by 6.

11. Add 11 oz. 11 dwt. 15 grs.; 7 oz. 12 dwt. 19 grs.; 10 oz. 13 dwt. 17 grs.

12. From 7 oz. 19 dwt. take 3 oz. 19 dwt. 21 grs.

NOTE. Apothecaries, in compounding medicines, use the following:

APOTHECARIES' MEASURE.

60 minims (℥)	= 1 dram (℥ lx.).
8 drams	= 1 ounce (fl. drm. viij.).
16 ounces	= 1 pint (fl. oz. xvj.).

TIME MEASURE.

Time Measure is used in measuring duration.

TABLE.

60 seconds (sec.)	= 1 minute (min.).
60 minutes	= 1 hour (hr.).
24 hours	= 1 day (dy.).
7 days	= 1 week (wk.).
365 days (or 52 wks. 1 dy.)	= 1 common year (yr.).
366 days	= 1 leap-year.
100 years	= 1 century.

1. Reduce 3 dys. 11 hrs. 32 min. to minutes.
2. Reduce 7 hrs. 30 min. 50 sec. to seconds.
3. Reduce 20,400 min. to higher denominations.
4. Reduce 481,200 sec. to higher denominations.
5. From 3 yrs. 15 dys. take 2 yrs. 12 dys. 23 hrs.
6. Divide 10 wks. 5 dys. 9 hrs. by 9.
7. Multiply 2 dys. 7 hrs. 15 min. by 8.
8. From 6 dys. 5 hrs. 48 min. 43 sec. take 13 hrs. 30 min. 45 sec.
9. Divide 31 dys. 2 hrs. 54 min. by 7.

COUNTING.

PAPER.		VARIOUS.	
24 sheets	= 1 quire.	12 things	= 1 dozen.
20 quires	= 1 ream.	12 dozen	= 1 gross.
2 reams	= 1 bundle.	12 gross	= 1 great gross.
5 bundles	= 1 bale.	20 things	= 1 score.

How many sheets make a ream?
How many pens make a gross?
How many buttons make a great gross?
How many years are 3 score and ten?

LONG MEASURE.

Long Measure is used in measuring lines or distances.

TABLE.

12 inches (in.)	= 1 foot (ft.).
3 feet	= 1 yard (yd.).
5½ yards, or 16½ feet	= 1 rod (rd.).
320 rods	= 1 mile (mi.).

1 mi. = 320 rds. = 1760 yds. = 5280 ft.

NOTE. A line = $\frac{1}{12}$ in.; a barleycorn = $\frac{1}{3}$ in.; a hand (used in measuring the height of horses) = 4 in.; a palm = 3 in.; a span = 9 in.; a cubit = 18 in.; a military pace = 2½ ft.; a chain = 4 rds.; a link = $\frac{1}{100}$ chain; a furlong = ⅛ mi.; a knot (used in navigation) = 6086 ft.; a league = 3 knots; a fathom (used in measuring depths at sea) = 6 ft.; a cable length = 120 fathoms.

NOTE. Lengths measured by yards are generally expressed in yards and fractions of a yard; and distances of 160 rds. and 80 rds. are called *half-miles* and *quarter-miles* respectively.

Reduce 283 inches to higher denominations.

12 | 283
3 | 23 . . . 7
7 . . . 2

7 yds. 2 ft. 7 in. *Ans.*

Reduce 328 yards to rods.

5½ | 328
2
11 | 656 **half-yards.**
59. . . 7 **half-yards.**

Since it takes 5½ yards, or 11 **half-yards,** to make a rod, reduce the 328 yards to *half-yards* and divide by 11. The quotient is 59 rods, and the remainder 7 half-yards. The 7 half-yards are equal to 3½ yards.

59 rds. 3½ yds. *Ans.*

What part of a yard are 9 in.? 18 in.?

What part of a mile are 160 rds.? 80 rds.?

How many yards in 2 rds.? in 3 rds.? in 4 rds.?

How many feet in 2 rds.? in 4 rds.? in 6 rds.?

1. Change 5 yds. 2 ft. 7 in. to inches.
2. Change 2 mi. 80 rds. 4 yds. to yards.
3. Change 2 mi. 268 rds. 2 yds. to yards.
4. Change 16 mi. 181 rds. to rods.
5. Change 15,840 ft. to miles.
6. Change 938 yds. to rods.
7. Change 720 rds. to miles.
8. Change 19,397 yds. to miles.

Add:

9.

yds.	ft.	in.
13	1	5
28	2	7
5	2	11

10.

yds.	ft.	in.
27	4	1
14	3	2
14	3	2

11.

mi.	rds.	yds.
15	25	5
3	27	3
12	36	2

12.

mi.	rds.	ft.
13	35	15
11	57	11
10	85	13
5	96	8

13.

mi.	rds.	ft.
7	140	10
5	230	12
3	275	5
1	255	11

14.

rds.	ft.	in.
170	8	9
115	11	11
130	14	8
175	13	7

Find the difference between:

15.

yds.	ft.	in.
14	1	4
3	1	5

16.

yds.	ft.	in.
22	0	0
3	2	6

17.

mi.	rds.	ft.
23	76	1
16	238	15

18.

mi.	rds.	ft.
17	125	1
8	257	14

19.

mi.	rds.	yds.
7	0	0
3	255	1

20.

mi.	rds.	yds.
13	33	2
4	0	$3\frac{1}{2}$

21. Multiply 15 yds. 1 ft. 9 in. by 11.
22. Multiply 21 rds. 4 yds. 2 ft. by 13.

SQUARE MEASURE.

Square Measure is used in measuring surfaces.

The units of square measure are squares having *linear* units for the lengths of their sides.

TABLE.

144 square inches (sq. in.)	= 1 square foot (sq. ft.).
9 square feet	= 1 square yard (sq. yd.).
$30\frac{1}{4}$ square yards, or $272\frac{1}{4}$ square feet	= 1 square rod (sq. rd.).
160 square rods, or 10 square chains	= 1 acre (A.).
640 acres	= 1 square mile (sq. mi.).

Hence, 1 A = 160 sq. rds. = 4840 sq. yds. = 43,560 sq. ft.

A square of flooring or roofing	= 100 sq. ft.
A section of land	= 1 mile square.
A township	= 36 sq. mi.

The units of square measure are obtained by squaring the units of linear measure. Thus,

$144 = 12^2$; $9 = 3^2$; $30\frac{1}{4} = (5\frac{1}{2})^2$; $272\frac{1}{4} = (16\frac{1}{2})^2$.

12^2 means 12×12.

1. Reduce 507 sq. yds. 7 sq. ft. to square feet.
2. Reduce 50 sq. rds. to square feet.
3. Reduce 3 A. 90 sq. rds. to square rods.
4. Reduce 44,996 sq. in. to square feet.
5. Reduce 68,531 sq. ft. to square yards.
6. Reduce 85,316 sq. rds. to acres.
7. Add: 3 A. 116 sq. rds.; 2 A. 120 sq. rds.; 5 A. 119 sq. rds.; 1 A. 40 sq. rds.
8. From 13 sq. yds. 7 sq. ft. 12 sq. in. take 3 sq. yds. 8 sq. ft. 136 sq. in.
9. Multiply 2 A. 20 sq. rds. by 9.

CUBIC MEASURE.

Cubic Measure is used in measuring solids.

The units of cubic measure are cubes having units of length for the lengths of their edges.

TABLE.

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.).
27 cubic feet = 1 cubic yard (cu. yd.).

The units of volume are cubes of the units of length. Thus, $1728 = 12^3$; $27 = 3^3$.

12^3 means $12 \times 12 \times 12$.

WOOD MEASURE.

TABLE.

16 cubic feet = 1 cord foot (cd. ft.).
8 cord feet = 1 cord (cd.).
Therefore, 128 cubic feet = 1 cord.

1. Reduce 13 cu. yds. 21 cu. ft. to cubic feet.

2. Reduce 600 cu. ft. to cubic yards.

3. From 58 cu. yds. 24 cu. ft. take 34 cu. yds. 26 cu. ft.

4. Multiply 13 cu. yds. 13 cu. ft. by 13.

5. Divide 17 cu. yds. 17 cu. ft. by 11.

6. Add: 34 cu. ft. 1621 cu. in.; 13 cu. ft. 1223 cu. in.; 17 cu. ft. 1000 cu. in.

7. How many cords of wood in 1200 cu. ft.?

8. How many cords of wood in a pile 42 ft. long, 8 ft. wide, and 6 ft. high?

NOTE. Divide the product of the *numbers* expressing the length, width, and height by 128.

9. How many cubic yards in a cord of wood?

10. At \$4 a cord, find the value of a pile of wood 18 ft. long, 4 ft. wide, and 4 ft. high.

ORAL EXERCISES.

How many inches in $\frac{3}{4}$ of a yard?

How many ounces in $\frac{5}{8}$ of a pound?

How many pounds in $\frac{1}{2}$ of a ton?

How many cubic feet in $\frac{8}{9}$ of a cubic yard?

How many square rods in $\frac{3}{4}$ of an acre?

How many cord feet in $\frac{7}{8}$ of a cord?

How many pints in $\frac{3}{16}$ of a gallon?

How many hours in $\frac{2}{3}$ of a day?

How many minutes in $\frac{3}{4}$ of an hour?

How many quarters of a pound in 2 pounds?

How many quarters of a dollar in $\$6\frac{3}{4}$? in $\$7\frac{1}{4}$?

How many halves of an apple in $4\frac{1}{2}$ apples?

I have a string $2\frac{3}{4}$ yards long. Into how many pieces, each $\frac{1}{4}$ yard long, can I cut it?

How many gallons will 10 bottles hold if each bottle holds $\frac{1}{5}$ of a gallon?

Find the price of $2\frac{1}{4}$ dozen of eggs at 16 cents a dozen.

Find the price of $3\frac{1}{2}$ pounds of sugar at 6 cents a pound.

How many miles will a man walk in 2 hours at the rate of $3\frac{1}{2}$ miles an hour?

How many miles will a man walk in $2\frac{1}{2}$ hours at the rate of 3 miles an hour?

How many miles will a man walk in 3 hours at the rate of $3\frac{1}{2}$ miles an hour?

Express 2 ft. 6 in. as the fraction of a yard.

At \$7 a ton what is the cost of $\frac{3}{4}$ of a ton of coal?

At \$6 a cord what is the cost of $\frac{7}{8}$ of a cord of wood?

At 80 cents a bushel what is the cost of $2\frac{1}{4}$ bushels of Baldwin apples?

SLATE EXERCISES.

Find the cost, to the nearest cent, of

1. $3\frac{3}{4}$ doz. of eggs at 24 cents a dozen.
2. $3\frac{1}{2}$ lbs. of steak at 23 cents a pound.
3. $2\frac{1}{2}$ lbs. of tea at 65 cents a pound.
4. $17\frac{3}{4}$ yds. of muslin at 10 cents a yard.
5. 50 cans of tomatoes at $1.25 a dozen.
6. $2\frac{3}{4}$ bu. of potatoes at 18 cents a peck.
7. 16 bu. of oats at $37\frac{1}{2}$ cents a bushel.
8. 24 bags of corn at 1.12\frac{1}{2}$ a bag.
9. 36 bu. of wheat at $87\frac{1}{2}$ cents a bushel.
10. 4 lbs. and 12 oz. of butter at 20 cents a pound.
11. 8 lbs. and 10 oz. of mutton at 12 cents a pound.
12. 6 qts. of molasses at 56 cents a gallon.
13. $43\frac{1}{2}$ yds. of cotton cloth at 7 cents a yard.
14. 14 lbs. 6 oz. of ham at 14 cents a pound.
15. 6 bu. and 3 pks. of wheat at 92 cents a bushel.
16. 2680 lbs. of hay at $22 a ton.
17. 2 t. 8 cwt. of coal at $5.60 a ton.
18. $3\frac{1}{2}$ bbls. of flour at $5.50 a barrel.
19. $2\frac{3}{4}$ bu. of cranberries at 7 cents a quart.
20. 3 pks. and 4 qts. of cranberries at $2.56 a bushel.
21. 2 cds. and 6 cu. ft. of wood at $3.50 a cord.
22. A pile of wood 26 ft. long, 4 ft. wide, and 5 ft. high at $3.84 a cord.
23. 4 doz. and 8 eggs at 30 cents a dozen.
24. 75000 bricks at $6.75 a thousand.
25. 9 shares of stock at $98\frac{1}{4}$ a share.

Part V.

LESSON 1.

PERCENTAGE.

A **percentage** of a number is the result obtained by taking a stated number of **hundredths** of it.

One **hundredth** of a number is called one **per cent** of it; two **hundredths,** two **per cent**; three **hundredths,** three **per cent**; and so on.

This sign % stands for the words **per cent.**

Thus, 5 % of 300 means 0.05 of 300.
$15\frac{1}{2}$ % of 300 means 0.15½ of 300.
$\frac{1}{4}$ % of 300 means 0.00¼ of 300.

When the per cent can be expressed as a common fraction in *small terms*, it is better to write it as a common fraction.

Hence 50 % of a number is $\frac{50}{100}$ or $\frac{1}{2}$ the number.

25 % of a number is $\frac{25}{100}$ or $\frac{1}{4}$ the number.

75 % of a number is $\frac{75}{100}$ or $\frac{3}{4}$ the number.

$12\frac{1}{2}$ % of a number is $\frac{12\frac{1}{2}}{100}$ or $\frac{1}{8}$ the number.

$8\frac{1}{3}$ % of a number is $\frac{8\frac{1}{3}}{100}$ or $\frac{1}{12}$ the number.

$16\frac{2}{3}$ % of a number is $\frac{16\frac{2}{3}}{100}$ or $\frac{1}{6}$ the number.

$33\frac{1}{3}$ % of a number is $\frac{33\frac{1}{3}}{100}$ or $\frac{1}{3}$ the number.

125 % of a number is $\frac{125}{100}$ or $\frac{5}{4}$ the number.

Find $16\frac{1}{3}\%$ of 336.

336
0.16⅓
112
2016
336
54.88

$16\frac{1}{3}\% = 0.16\frac{1}{3}$.

54.88. *Ans.*

Find $16\frac{2}{3}\%$ of 336.

$16\frac{2}{3}\% = \frac{1}{6}$.

$\frac{1}{6}$ of 336 = 56.

56. *Ans.*

Hence, to find a per cent of a number:

Multiply the number by the given per cent.

Find:

1. 6% of 175.
2. 25% of 300.
3. $16\frac{2}{3}\%$ of 480 men.
4. $5\frac{1}{3}\%$ of 675 sheep.
5. 10% of 1560 dys.
6. $33\frac{1}{3}\%$ of \$840.
7. 50% of 1216 oz.
8. $66\frac{2}{3}\%$ of 1518 lbs.
9. 75% of 2040 ft.
10. $12\frac{1}{2}\%$ of 1648 mi.

To find the per cent one given number is of another.

What per cent of 9 is 3?

Since 1 is $\frac{1}{9}$ of 9, 3 is $3 \times \frac{1}{9} = \frac{3}{9} = \frac{1}{3}$; and $\frac{1}{3} = 3)\overline{1.00}$ $0.33\frac{1}{3}$

The same result is obtained if we divide 3 by 9. $9)\overline{3.00}$ $0.33\frac{1}{3} = 33\frac{1}{3}\%$.

Hence, to find the per cent one number is of another:

Divide the number which represents the percentage by the other number, carrying the division to hundredths.

What per cent of

1. 90 is 30?
2. 960 is 24?
3. 30 is 90?
4. 24 is 960?
5. 4108.5 is 821.7?
6. 2740 mi. are 548 mi.?
7. 36 in. are 27 in.?
8. \$2.75 are \$0.35?
9. 2240 lbs. are 2000 lbs.?
10. 7000 grs. are 5760 grs.?

To find a number when a per cent of it is given.

3240 is $37\frac{1}{2}\%$ of what number?

$37\frac{1}{2}\% = \frac{37\frac{1}{2}}{100} = \frac{3}{8}$. If 3240 is $\frac{3}{8}$ of some number, $\frac{1}{8}$ of the number is $\frac{1}{3}$ of 3240 = 1080, and $\frac{8}{8}$ is $8 \times 1080 = 8640$. *Ans.*

The same result is obtained if we divide 3240 by $0.37\frac{1}{2}$.

Hence, to find a number when a per cent of it is given:

Divide the given number by the given per cent.

NOTE. Use the shorter method given above when it is possible to express the per cent by a common fraction in small terms.

1. 100 is 25% of what number?
2. 75 is 15% of what number?
3. \$360 is $83\frac{1}{3}\%$ of what number of dollars?
4. 4655 ft. is $87\frac{1}{2}\%$ of what number of feet?
5. 23.37 in. is 30% of what number of inches?
6. 142.6 bu. is 23% of what number of bushels?
7. 4275 lbs. is $33\frac{1}{3}\%$ of what number of pounds?
8. \$24.25 is $12\frac{1}{2}\%$ of what number of dollars?
9. 380 bu. is 250% of what number of bushels?
10. 80 horses is $6\frac{1}{4}\%$ of what number of horses?
11. 1260 yds. is 140% of what number of yards?
12. 1260 is $8\frac{1}{3}\%$ of what number?

Ex. 1. 45 is $12\frac{1}{2}\%$ more than what number?

Since the number is 100% of itself, and 45 is $12\frac{1}{2}\%$ more, 45 is $100\% + 12\frac{1}{2}\% = 112\frac{1}{2}\%$ of the number; that is, $\frac{9}{8}$ of the number. If 45 is $\frac{9}{8}$, $\frac{1}{8}$ is $\frac{1}{9}$ of 45, and $\frac{8}{8}$ is $8 \times \frac{1}{9}$ of $45 = 40$.

Ex. 2. 42 is $12\frac{1}{2}\%$ less than what number?

Since the number is 100% of itself, and 42 is $12\frac{1}{2}\%$ less, 42 is $100\% - 12\frac{1}{2}\% = 87\frac{1}{2}\%$ of the number; that is, $\frac{7}{8}$ of the number. If 42 is $\frac{7}{8}$, $\frac{1}{8}$ is $\frac{1}{7}$ of 42, and $\frac{8}{8}$ is $8 \times \frac{1}{7}$ of $42 = 48$.

13. 182 is 40% more than what number?
14. 156 is 40% less than what number?

PROFIT AND LOSS.

The difference between the buying and selling prices of goods is called **profit**, if the selling price is higher than the cost price, and **loss**, if the selling price is lower than the cost price.

When a profit or loss is said to be so much per cent, it is always understood that the percentage is reckoned on the **cost price.**

Find the profit, and the rate of profit, if goods costing \$5 are sold for \$7:

The profit is $\$7 - \$5 = \$2$.

The rate of profit is $\frac{\$2}{\$5} = 0.40$; that is, 40%.

Find the profit or loss, and the rate of profit or loss, given:

	COST.	SELLING PRICE.		COST.	SELLING PRICE.
1.	\$100.	\$120.	5.	\$180.	\$189.
2.	\$150.	\$160.	6.	\$30.	\$24.60.
3.	\$250.	\$300.	7.	\$42.	\$35.70.
4.	\$120.	\$138.	8.	\$35.	\$42.35.

Find the profit and the selling price, if goods costing \$10 are sold at 12% profit:

The profit is 12% of \$10, or \$1.20.

The selling price is cost + profit; that is, \$10 + \$1.20, or \$11.20.

Find the profit or loss, and the selling price, given:

	COST.	RATE OF PROFIT.		COST.	RATE OF LOSS.
9.	\$200.	5 %.	13.	\$250.	$2\frac{1}{2}$ %.
10.	\$275.	8 %.	14.	\$36.40.	10 %.
11.	\$325.	6 %.	15.	\$42.42.	$16\frac{2}{3}$%.
12.	\$450.	$6\frac{1}{2}$%.	16.	\$40.40.	$12\frac{1}{2}$%.

COMMISSION.

Commission is the charge made by an agent for transacting business for another.

Commission is reckoned at a rate per cent on the proceeds of sales, on collections, on the cost of purchases, and on the amount of investments.

EXERCISES.

1. An agent bought $1500 worth of cotton. Find the amount of his commission at 3%.

2. An agent sold 8000 yards of coarse cotton cloth at 6 cents a yard. Find his commission at $2\frac{1}{2}$%.

3. An agent sold a house and lot for $7500. He charged $2\frac{1}{2}$% commission and remitted the balance to his principal. How much was the sum remitted?

4. A merchant sent his agent $5150 to be invested in flour. If the flour is $5 a barrel, and the agent charges 3% commission for buying the flour, how many barrels will the agent buy?

NOTE. Since 3% of $5 is 15 cents, the person who remits the money pays, including the commission, $5.15 a barrel.

5. If a collector receives $2\frac{1}{4}$% commission for collecting, how much will he receive for collecting $1300?

6. If an agent collects $957 on a commission of $2\frac{1}{3}$%, what will the commission amount to?

7. James Holman sold for a farmer 28 bales of cotton averaging 500 pounds each, for $8\frac{1}{2}$ cents a pound, and charged 5% for selling. How much did the farmer receive for his cotton?

8. If an agent receives $3120 with which to buy goods on 4% commission, how much commission will he receive?

A sum of money imposed upon the persons or property of citizens for public purposes is called a **tax.**

Before taxes are assessed, a complete inventory of all the taxable property must be made.

If the assessment includes a *poll tax;* that is, a tax upon every voter between the ages of 21 and 70; a complete list of all the taxable polls must be made.

In New Hampshire the assessed value of every poll is $100. In some states the tax upon each poll is a sum fixed by law, and is generally $1, or $1.50.

Find the tax rate in the following example:

In 1892, the appropriations for all purposes by the town of C in New Hampshire amounted to $44,332. The valuation of the town, including 845 polls at $100 each, was $2,803,000.

The town received from the literary fund, $734.72; railroad tax, $3604.79; insurance tax, $126; and savings bank tax, $4022.20.

Find the tax rate.

SOLUTION.

Received from the savings bank tax . .	$4022.20
Received from the railroad tax	3604.79
Received from the literary fund . . .	734.72
Received from the insurance tax . . .	126.00
Whole amount received	$8487.71
Total appropriations	$44,332
Whole amount received	8,487.71
Balance to be raised	$35,844.29

To find the tax rate, divide the sum to be raised by the valuation.
In this case divide $35,844.29 by $2,803,000.
The quotient will be 0.0128, the tax rate.
This tax rate is generally stated as $12.80 on $1000.

To facilitate the making of taxes, assessors generally prepare a table like the following:

PROP.	TAX.	PROP.	TAX.	PROP.	TAX.	PROP.	TAX.
$1	$0.0128	$10	$0.1280	$100	$1.280	$1000	$12.80
2	0.0256	20	0.2560	200	2.560	2000	25.60
3	0.0384	30	0.3840	300	3.840	3000	38.40
4	0.0512	40	0.5120	400	5.120	4000	51.20
5	0.0640	50	0.6400	500	6.400	5000	64.00
6	0.0768	60	0.7680	600	7.680	6000	76.80
7	0.0896	70	0.8960	700	8.960	7000	89.60
8	0.1024	80	1.0240	800	10.240	8000	102.40
9	0.1152	90	1.1520	900	11.520	9000	115.20

Find Mr. James Brown's tax by this table on $8875.

The tax by table on	$8000 =	$102.40
The tax by table on	800 =	10.24
The tax by table on	70 =	0.896
The tax by table on	5 =	0.064
Total tax on	$8875 =	$113.60

Find by this table the tax

1. On property of James Otis, assessed at $10,500.
2. On property of Jacob Fernald, assessed at $7850.
3. On property of John Prentiss, assessed at $9762.
4. On property of Orin Peavey, assessed at $2020.
5. On property of Owen Elliott, assessed at $1586.
6. On property of Samuel Kelly, assessed at $11,645.
7. On property of Henry Gardner, assessed at $6487.
8. On property of Henry Jordon, assessed at $8964.
9. On property of George Folsom, assessed at $10,277.
10. On property of John Corning, assessed at $12,568.
11. On property of Henry Eastman, assessed at $9333.

INTEREST.

Money paid for the use of money is called **Interest.**

The money at interest is called the **Principal.**

The sum of the interest and principal is called the **Amount.**

Find the interest on $525 for 1 yr. and 6 mos. at 5%.

$5.25
0.05
$26.25
1½
13.12½
26.25
$39.37½

As there are 12 months in a year, 1 yr. 6 mos. = $1\frac{6}{12}$ = 1½ yrs.

The interest for 1 yr. at 5% is 0.05 of the principal, and 0.05 of $525 is $26.25. For 1 yr. and 6 mos., the interest is 1½ times as much as for 1 yr. Hence, we multiply the $26.25 by 1½ and obtain $39.37½ for the answer.

Hence,

To find the interest for a given number of years and months at 6% :

Find the interest for one year at 6% and multiply this interest by the time expressed in years.

Find the interest on

1. $676 for 2 yrs. 3 mos. at 4%.
2. $820 for 1 yr. 4 mos. at 6%.
3. $750 for 10 mos. at 3⅓%.
4. $220 for 2 yrs. 6 mos. at 4½%.
5. $576 for 3 yrs. at 2½%.
6. $75.30 for 2 yrs. at 3½%.
7. $80.20 for 1 yr. and 3 mos. at 6%.
8. $97.20 for 2 yrs. 5 mos. at 5%.
9. $1200 for 1 yr. 8 mos. at 4%.
10. $1600 for 1 yr. 9 mos. at 5½%.
11. $218.50 for 1 yr. 6 mos. at 3%.

12. $1200 for 4 mos. at $3\frac{1}{2}\%$.
13. $1700 for 3 mos. at 5%.
14. $1600 for 5 mos. at $5\frac{1}{2}\%$.
15. $1800 for 8 mos. at $4\frac{1}{2}\%$.
16. $2100 for 6 mos. at 6%.

To find interest for a given number of months at 6%

Put the decimal point two places to the left in the principal, and multiply by one-half the number of months.

Find the interest on $630 for 4 mos. at 6%.

$6.30
2
$12.60

Here we put the decimal point *two places to the left* in the principal, and multiply by 2; that is, by $\frac{1}{2}$ of 4.

If we wished to find the interest at $4\frac{1}{2}\%$, we should divide the $12.60 by 6, and multiply the quotient by $4\frac{1}{2}$.

Find the interest on

1. $1220.40 for 3 mos. at 6%.
2. $2512.80 for 4 mos. at 5%.
3. $2084.20 for 1 mo. at $4\frac{1}{2}\%$.
4. $4500.60 for 5 mos. at $5\frac{1}{2}\%$.
5. $7508.50 for 6 mos. at $3\frac{1}{2}\%$.
6. $8501.20 for 3 mos. at 5%.
7. $9056.75 for 7 mos. at 6%.

To find the amount:

Find the interest and add it to the principal.

Find the amount of:

8. $1000 for 4 mos. at 6%.
9. $1500 for 6 mos. at 4%.
10. $75.50 for 4 mos. at 5%.

To find interest for a given number of days at 6% :

Put the decimal point three places to the left in the principal, and multiply by one-sixth of the number of days.

Find the interest on \$7260 for 90 dys. at 6%.

\$7.260
15
\$108.900

Here we put the decimal point *three* places to the left in the principal, and multiply by 15 ; that is, by $\frac{1}{6}$ of 90.

To find the interest for any other rate than 6 per cent :

Find the interest at 6 %, divide the result by 6, and multiply the quotient by the given rate.

If the time is given in months and days, or in years, months, and days, reduce the time to days, reckoning 30 days for a month, and 360 days for a year.

Find the interest on

1. \$3600 for 30 dys. at 6%.
2. \$4500 for 33 dys. at 6%.
3. \$8000 for 93 dys. at 6%.
4. \$9875 for 60 dys. at 5%.
5. \$2525 for 63 dys. at $4\frac{1}{2}$%.
6. \$3750 for 90 dys. at $3\frac{1}{3}$%.
7. \$15.80 for 63 dys. at 4%.
8. \$256.40 for 45 dys. at $5\frac{1}{2}$%.
9. \$645.25 for 123 dys. at 3%.
10. \$950.50 for 2 yrs. 4 mos. 6 dys. at 6%.
11. \$20,000 for 1 yr. 7 mos. at 4%.
12. \$515.25 for 1 yr. 9 mos. 8 dys. at $4\frac{1}{2}$%.
13. \$1000 for 2 yrs. 1 mo. 19 dys. at 5%.
14. \$216.75 for 2 yrs. 2 mos. 21 dys. at $5\frac{1}{2}$%.
15. \$927.35 for 1 yr. 8 mos. 28 dys. at 3%.

BANK DISCOUNT.

The following is a common form of a *Promissory Note:*

$912.50. BOSTON, MASS., Sept. 6, 1892.

Ninety days from date I promise to pay George Bell or order nine hundred twelve and $\frac{50}{100}$ dollars, value received.

JAMES MARTIN.

If Mr. Bell gets this note *discounted* at a bank, he *indorses* it by writing his name across the back. The bank charges interest on the sum named in the note for the 90 days it has to run, and 3 days more, called *days of grace*. The note is not legally due until the last day of grace, called the *day of maturity*. The interest charged is called the *bank discount*, and the difference between the sum named in the note and the discount is called the *proceeds* of the note. The proceeds is the money paid by the bank to the owner of the note.

A note to be sold must be made payable to *bearer*, or to the order of some person who must indorse the note. If the *indorser* writes above his name the words "without recourse" he is not responsible for the payment of the note.

Find the *day of maturity* and the *proceeds* of the above note, if discounted at 6% on the day of its date.

To find the day of maturity we count 93 days from Sept. 6. There are 24 days left in September, 31 days in October, 30 days in November, making 85 days, and 8 days in December make the 93 days. Hence the note is due Dec. 8.

We next find the *discount* by finding the interest on $912.50 for 93 days. (See page 202.)

$0.91250
$15\frac{1}{2}$
45625
456250
91250
$14.14375 *discount*

$912.50
14.14
$898.36 *proceeds*

Find the day of maturity and the proceeds of

1. A note for $1000 discounted May 1, for 30 dys., at 6%.

2. A note for $875 discounted June 10, for 60 dys., at 6%.

3. A note for $524.80 discounted July 6, for 90 dys., at 6%.

4. A note for $1124.50 discounted March 8, for 30 dys., at 5%.

5. A note for $1200.75 discounted Aug. 10, for 90 dys., at $4\frac{1}{2}$%.

The following is the common form of a promissory note that bears interest:

$1000. NEW YORK, APRIL 13, 1893.

Six months from date I promise to pay to the order of Robert Cumnock one thousand dollars, value received, with interest at 6%.

JAMES WINSOR.

A demand note is written as follows:

$1200. BALTIMORE, APRIL 13, 1893.

On demand I promise to pay to the order of John Silver twelve hundred dollars, value received, with interest at 6%.

GEORGE THOMAS.

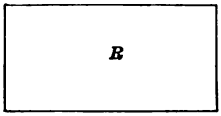
If a note bears interest and is discounted at a bank the discount is computed on the *amount* of the note.

The interest on the note is reckoned for *three days more* than the time named in the note.

6. If Robert Cumnock gets the above note of $1000 discounted at a bank July 13, paying 5% discount, find the day of maturity, and the proceeds of the note.

MEASUREMENTS.

A **Rectangle** is a flat surface bounded by four straight lines, and having four square corners.



A page of a book and a face of a slate are rectangular.

A **Square** is a rectangle with all its sides equal.

A **Rectangular Solid** is a solid bounded by six rectangles.

A book, a plank, a block, a brick, are rectangular solids.

A **Cube** is a rectangular solid whose faces are squares.

The **dimensions of a surface** are its length and breadth.

The **dimensions of a solid** are its length, breadth, and thickness. In writing the dimensions of surfaces and solids, the sign × is used for the word *by*, and one accent (′) for the word *feet*, and two accents (″) for word *inches*.

Thus the dimensions of a rectangle 4 feet long and 3 feet wide would be expressed by $4' \times 3'$, and read "four feet by three feet."

The dimensions of a square stick of timber 16 feet long, 10 inches wide, and 8 inches thick, would be expressed by $16' \times 10'' \times 8''$, and read "sixteen feet by ten inches by eight inches."

Measure to the nearest inch and express in accent notation:

1. A page of your reader.
2. The top of your desk.
3. A pane of glass.
4. One face of your slate.
5. The face of the blackboard.
6. A panel of the door.
7. A page of your copybook.
8. The floor of the room.

PERIMETERS.

The **Perimeter** of any surface bounded by straight lines is the sum of the lengths of the bounding lines.

Draw rectangles of the following dimensions and *measure* their perimeters:

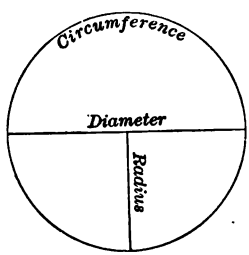
$2'' \times 3''$.	$2'' \times 4''$.	$1' \times 1'$.	$1'\ 3'' \times 6''$.
$3'' \times 3''$.	$3'' \times 5''$.	$1' \times 2'$.	$3' \times 3'$.
$3'' \times 4''$.	$4'' \times 6''$.	$1'\ 2'' \times 4''$.	$2'\ 6'' \times 1'\ 6''$.

Find the perimeter of

1. A rectangular floor $15' \times 15'$.
2. A rectangular ceiling $22' \times 20'$.
3. A rectangular room $16' \times 18'$.
4. A rectangular room $24' \times 21'$.

5. Find the cost of fencing a rectangular field 30 rds. $\times$ 20 rds., at \$1.20 a rod.

The length of the circumference of a circle is very nearly $3\frac{1}{7}$ times the length of the diameter of the circle.



Find the length of the circumference of a circle:

6. If the length of the diameter is 21 in.; 1 ft. 9 in.; 7 ft. 6 in.
7. If the radius is 3 ft. (Radius equals $\frac{1}{2}$ diameter.)
8. If the radius is 1 ft. 4 in.; 2 ft. 3 in.

Find the length of the diameter of a circle:

9. If the length of the circumference is 11 in.
10. If the length of the circumference is 2 ft. 9 in.
11. If the length of the circumference is 3 ft. 8 in.
12. If the length of the circumference is 4 ft. 6 in.

AREAS.

The **area** of any surface is the **number of units of area** the given surface contains.

The **unit of area** is a square, the side of which is some given *unit of length.*

Find the area of a rectangle $2' 3'' \times 1' 8''$:

$2' 3'' = 24 + 3$ in. $= 27$ in.
$1' 8'' = 12 + 8$ in. $= 20$ in.

Therefore the area required is $20 \times 27 = 540$ sq. in.

Rule for finding the area of a rectangle:

Express the length and breadth in units of the same denomination; multiply the number of units in the length by the number of units in the breadth, and this product will be the number of square units of that denomination.

Find the area of a rectangle:

1. $8'' \times 5''$.	**4.** $11'' \times 10''$.	**7.** $3' \times 2'\ 6''$.
2. $9'' \times 6''$.	**5.** $1'\ 2'' \times 6''$.	**8.** $4'\ 3'' \times 2'$.
3. $8'' \times 7''$.	**6.** $1'\ 3'' \times 4''$.	**9.** $1'\ 9'' \times 2'\ 3''$.

10. How many square feet in a floor 21 ft. by 20 ft.?

11. How many square feet in a floor 18 ft. by 15 ft.?

12. How many square feet in a blackboard 12 feet long, and $3\frac{1}{2}$ feet wide?

13. How many square yards in a roll of wall-paper 18 in. wide and 8 yds. long?

14. Find the number of square yards in a house-lot 87 ft. front and 100 ft. deep.

15. Find the number of square rods in a house-lot 8 rods front and 10 rods deep.

16. Find the total area of the *four walls* of a room 18 ft. long, 17 ft. wide, and $9\frac{1}{2}$ ft. high.

1. Find the total area of the four walls and the ceiling of a room 16 ft. long, 15 ft. wide, and 10 ft. high.

2. Find the total area in square yards of the ceiling of a room 18 ft. long, and 17 ft. wide.

3. Find the area in square yards of the four walls of a room 20 ft. long, 17 ft. wide, and 10 ft. high.

4. Find the number of acres in a field 40 rds. sq.

5. Find the number of square yards in a plot that is 3 yds. 2 ft. square.

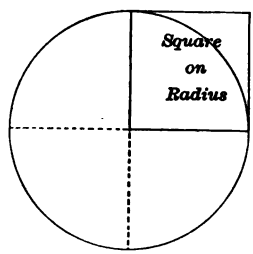
6. Find the number of square yards in a plot that is 24 ft. 8 in. long, and 12 ft. 4 in. wide.

7. Find the number of square inches in the surface of a brick $8'' \times 4'' \times 2\frac{1}{2}''$.

8. Find the number of square inches in the surface of a crayon-box $7'' \times 4'' \times 3''$.

9. Find the number of square feet in the surface of a cube $3' \times 3' \times 3'$.

The area of a circle is very nearly $3\frac{1}{7}$ times the area of the square on its radius.



Find the area of a circle:

10. If the length of the radius is 10 in.; 16 in.; 20 in.

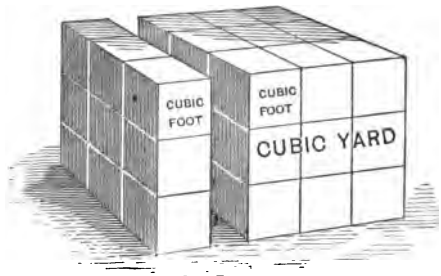
11. If the length of the radius is 1 ft. 4 in.; 1 ft. 6 in.

12. If the length of the diameter is 1 ft. 10 in.; 2 ft. 4 in.

13. If the length of the diameter is 2 ft. 6 in.; 3 ft. 4 in.; 3 ft. 8 in.; 3 ft. 10 in.

14. If the length of the diameter is 4 ft. 2 in.; 4 ft. 4 in.; 4 ft. 6 in.; 4 ft. 8 in.

VOLUMES.



The **volume** of any solid is the **number of units of volume** the given solid contains.

The **unit of volume** is a cube, the edge of which is some given *unit of length.*

Rule for finding the volume of a rectangular solid:

Express the length, breadth, and thickness in units of the same denomination; multiply the number of units in the length by the number of units in the breadth, and this product by the number of units in the thickness, and the result will be the number of cubic units of that denomination.

Find the volume of a rectangular solid:

1. $8'' \times 4'' \times 3''$.
2. $4' \times 4'' \times 3''$.
3. $4'' \times 4'' \times 4''$.
4. $7'' \times 3'' \times 4''$.
5. $10' \times 8'' \times 4''$.
6. $3' \times 3' \times 3'$.

7. Find the number of cubic feet in a stick of square timber 30 ft. long, 15 in. square at the end.

8. Find the number of cubic yards in an excavation for a cellar $40' \times 32' \times 8'$.

9. Find the number of cubic yards in an excavation for a cellar $32' \times 24' \times 7'$.

CARPETING FLOORS.

In carpeting floors, decide whether the strips shall run lengthwise of the room or across it, and find the number of strips required by dividing the width of the room by the width of the carpet, if the strips are to run lengthwise of the room; and the length of the room by the width of the carpet, if the strips are to run across it. A fraction of a width of carpeting required is reckoned a full width, and enough is **turned under** to make the carpet fit the room.

The number of yards in the length of the strip required multiplied by the number of strips will give the number of yards of carpeting required.

In determining the length of the strip, *allowance must be made for matching the patterns.*

Ex. Find the number of strips of carpeting $\frac{3}{4}$ yd. wide required for a room $18' \times 17'$, if the strips run lengthwise.

SOLUTION.

17 ft. $= 17 \times 12$ in. $= 204$ in.

$\frac{3}{4}$ yd. $= \frac{3}{4}$ of 36 in. $= 27$ in.

$204 \div 27 = 7\frac{5}{27}$.

Therefore 8 strips are required.

1. Find the number of strips of carpeting 1 yd. wide required for a room $17' \times 15'$, if the strips run lengthwise.

2. Find the number of strips of carpeting $\frac{3}{4}$ yd. wide required for a room $20' \times 22'$, if the strips run across the room.

3. Find the number of yards of carpeting 1 yd. wide required for a room $17'\,6'' \times 17'$, if the strips run lengthwise. What width will be turned under?

PAPERING ROOMS.

Wall-paper is made in strips 18 in. wide. Single rolls are 8 yds. long, and double rolls are 16 yds. long.

To find the number of rolls required to paper a room of common height.

Find the number of feet in the perimeter of the room, omitting the width of the doors and windows; and allow a double roll, or two single rolls, for every 7 feet of the perimeter.

Find the number of rolls required for a room of ordinary height, $17' \times 15'$, having 1 door and 3 windows each 4 ft. wide.

Perimeter of the room $= 2 \times 17' + 2 \times 15' = 64'$
Width of door and windows $= 16'$
Deducting, we have $48'$
$48 \div 7 = 6\frac{6}{7}$.

Ans. 7 double rolls.

1. How many double rolls of paper will be required for a room $20' \times 18'$, with 2 doors and 3 windows, each 4 ft. wide?

2. Find the cost of paper at 50 cents a single roll for a room $21' \times 19'$, with 2 doors and 4 windows, each $4'\,2''$ wide.

3. Find the cost of paper at 30 cents a single roll for a room $16' \times 15'$, with 1 door and 2 windows, each 4 ft. wide.

4. How many double rolls of paper will be required for a room 18 ft. by 16 ft.?

5. How many double rolls of paper will be required for a room 14 ft. by 16 ft.?

PAINTING AND PLASTERING.

The unit of measure for painting, plastering, and paving is the *square yard.*

It is customary to find the *total area* of the work, to deduct from this amount *half the area* of all openings, and to take the remainder as the net area.

A fraction of a square yard in the net area is omitted if less than $\frac{1}{2}$, and in other cases is reckoned as 1 sq. yd.

Find the cost of plastering a room $15' \times 14' \times 9'$, if the base-board is 1 ft. high, and if there is one door $7' \times 4'$, and two windows $6' \times 4'$, at 18 cents a square yard.

SOLUTION.

Perimeter of room	$= 2 \times 15' + 2 \times 14' = 58'$	
Height of room above base-board	$= 9' - 1' = 8'$	
Total area of walls	$= 8' \times 58'$	$= 464$ sq. ft.
Total area of ceiling	$= 15' \times 14'$	$= 210$ sq. ft.
Total area of walls and ceiling		$= 674$ sq. ft.
Height of door above base-board	$= 7' - 1' = 6'$	
Area of door above base-board	$= 4' \times 6'$	$= 24$ sq. ft.
Area of the two windows	$= 2 \times 4' \times 6'$	$= 48$ sq. ft.
Area of door and windows		$= 72$ sq. ft.
Half this area	$= \frac{1}{2}$ of $72 = 36$ sq. ft.	
Net area	$= 674 - 36$	$= 638$ sq. ft.

and 638 sq. ft. $= \frac{638}{9} = 70\frac{8}{9}$ sq. yds.

71×18 cents $= \$12.78$. *Ans.*

1. Find the cost of plastering a room at 20 cents a square yard, if the room is $18' \times 17' \times 9'\ 8''$, and has a base-board 8 in. high, 2 doors $8' \times 4'\ 6''$, and 3 windows $6'\ 6'' \times 4'$.

2. Find the cost, at 20 cents a square yard, of painting the walls of a room $20' \times 18' \times 10'$, if the base-board is 1 ft. high, and the net allowance for openings is 80 sq. ft.

BOARD MEASURE.

Boards, planks, and all squared lumber are sold by the thousand feet, board measure.

To find the number of feet, board measure, of boards one inch or less in thickness:

Express the length and the width in feet. The product of these numbers will be the number of feet, board measure.

To find the number of feet, board measure, of boards more than one inch thick, planks, and squared lumber:

Express the length and the width in feet, and the thickness in inches. The product of these numbers will be the number of feet, board measure.

Find the number of feet board measure in a square stick of timber 20 ft. long, 10 in. wide, and 8 in. thick.

$$10 \text{ in.} = \tfrac{10}{12} \text{ ft.} = \tfrac{5}{6}$$

$$20 \times \tfrac{5}{6} \times 8 = \tfrac{800}{6} = 133\tfrac{1}{3}.$$

$133\frac{1}{3}$ ft. *Ans.*

Find the number of feet, board measure, in

1. 2 boards 15 ft. long, 8 in. wide, and 1 in. thick.
2. 3 boards 12 ft. long, 10 in. wide, and 1 in. thick.
3. 10 boards 16 ft. long, 9 in. wide, and 1 in. thick.
4. 20 boards 16 ft. long, 10 in. wide, and $\frac{1}{2}$ in. thick.
5. 30 boards 14 ft. long, 12 in. wide, and $\frac{3}{4}$ in. thick.
6. 25 planks 20 ft. long, 10 in. wide, and 3 in. thick.
7. 40 planks 18 ft. long, 12 in. wide, and 4 in. thick.
8. 30 joists 16 ft. long, 4 in. wide, and 4 in. thick.
9. 20 joists 14 ft. long, 8 in. wide, and 6 in. thick.
10. 10 joists 12 ft. long, 4 in. wide, and 6 in. thick.

PRACTICAL RULES FOR REFERENCE.

Laths are each 4 ft. long, and put up in bundles of 100 pieces; that is, 10 bundles to the 1000.

To find the number of laths required to cover a given area:

Find the net area, and allow 1 *bundle for every* 5 *sq. yds.*

Clapboards are 4 ft. long, and are put up in bundles of 100; that is, 10 bundles to the 1000.

To find the number of clapboards required to cover a given area:

Find the net area, and allow 1 *bundle for every* 120 *sq. ft., if the clapboards are laid* 4 *in. to the weather.*

Shingles are 16 in. long, and are estimated to average 4 in. wide. They are put up in bunches, 4 bunches to the 1000.

To find the number of shingles required to cover a given area:

Find the net area, and allow 1000 *for every* 100 *sq. ft., if the shingles are laid* 4 *in. to the weather.*

Nails are put up in kegs, 100 lbs. to a keg.

NOTE. *Allow* 6 *lbs. of* 4*-penny, or* 5 *lbs. of* 3*-penny, nails for laying* 1000 *shingles;* 4 *lbs. of* 5*-penny nails for* 1000 *clapboards;* 7 *lbs. of* 3*-penny nails for* 1000 *laths.*

Bricks are sold by the thousand.

To find the number of bricks required for a building:

Find the number of cubic feet in the walls, taking the outside dimensions, and allow 22 *bricks for every cubic foot.*

Lime is sold by the cask of 240 lbs.

To find the number of casks of lime required for a given amount of brickwork, or of plastering:

Allow 1 *cask of lime for every* 1000 *of bricks, or for every* 30 *sq. yds. of plastering.*

NOTE. For plastering allow 5 lbs. of hair for each cask of lime. For brickwork and plastering, allow about $\frac{1}{2}$ load of sharp sand for every cask of lime.

Cement is sold by the cask of 300 lbs., and is usually mixed with sharp sand, 1 part of cement and 2 parts of sand.

Allow 1 *cask of cement to every* 600 *bricks for brickwork. Allow* 1 *cask of cement mixed with* 4 *times its bulk of clean gravel for every* 9 *sq. yds. of concrete.*

To find the number of gallons a rectangular cistern will hold:

Express the interior dimensions in inches, and divide the product of the three dimensions by 231.

To find the number of gallons a round cistern will hold:

Express the diameter and the depth in inches.

Take half the diameter and square it, multiply the result by $3\frac{1}{7}$, *and this product by the depth, then divide by* 231.

To find the number of bushels of grain in a bin:

Take $\frac{4}{5}$ *of the number of cubic feet in the bin, and add to the result* $\frac{1}{2}$ *of* 1% *of it.*

To find the number of cubic feet required for a given number of bushels:

To the number of bushels add $\frac{1}{4}$ *of the number, and subtract from the sum* $\frac{1}{2}$ *of* 1% *of it.*

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